Contributions to

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BY MARCUS E. JONES.

The following paper on Allium is the result of an attempt to arrange the species of onions in systematic order so far as they are known to exist in the Great Basin and adjoining regions. Outside species are mentioned by way of comparison, and all are arranged in what the writer believes to be the genetic order, so as to save repetition. Nearly all the Great Basin species have been studied critically in the field. The illustrations are all from actual bulb coats drawn to a scale of forty diameters, and each number under a figure represents the number of the species in this paper.

ZONAL DISTRIBUTION.

Without going into discussion of the terms used in relation to zonal distribution, the writer will give a summary of what he published several years ago. The flora of the World is divisible into two grand divisions, Tropical and Temperate. The Tropical flora is bounded by the isotherm of 58° annual temperature approximately but varies down to 56° in very dry regions, and above 60° in humid regions. For our region in the dry areas its characteristic zonal plant is Larrea tridentata. in California it is Adenostoma fasciculata.

The Temperate grand division is separable into Lower, Middle, Upper, and Frigid.

The Lower Temperate ranges down to 50-52° annual temperature according to the humidity, its characteristic zonal plant is Juniperus Utahensis (which gives the name Juniper Belt

or Zone to this division). Pinus monophylla also has the same distribution but is less common, in our region. The apple and peach have nearly the same distribution but the apple runs up a little into the Middle Temperate while the peach runs down a little into the Tropical but stops short at the upper edge of the Lower Temperate. This is the Upper Sonoran of Merriam but has no relation to the Tropical Zone in which it is placed by him, its whole flora is distinctly Temperate. The sagebrush (Artemisia tridentata) also stops short off at the lower edge of the Lower Temperate but goes entirely through the Middle Temperate also.

The Middle Temperate is limited by the upper edge of the distribution of Juniperus Utahensis and runs to the upper limit of the sagebrush and the deciduous oak (Quercus Gambelii), it also touches the lower edge of the distribution of the spruce and aspen in the Great Basin, though the latter is of no value zonally in Idaho or the eastern States as it runs far down into the Middle Temperate in those regions. The characteristic plant of this zone is the deciduous oak and gives it the name of Oak Belt or Zone. Pinus ponderosa is also a good zonal plant for this belt in the Great Basin; but in Idaho it runs up a little too far in the Upper Temperate. This division is the Transition of Merriam but it is a poor name as it shows no transition to the Tropical as Merriam supposed, and shows less intermingling of floras than the Upper Temperate.

The Upper Temperate is characterized by the spruce and many other conifers, and runs up to the treeless regions or flora, from the upper edge of the sagebrush and oak distribution. It is called the Spruce Belt or Zone.

The Frigid Zone cannot be kept distinct from the Temperate as it has neither genera nor species sufficient to warrant any-

thing but to rank as a subdivision. It is divisible into the Alpine and Arctic according to whether it is found on mountain tops or not.

A peculiar feature in the life zones is the tendency to form tongues along streams which run far down into the lower zone, and other tongues on dry south slopes which run far up into the upper zone. These must be considered in determining the life zone of a species. These tongues are more extended as the temperature falls. All the so-called subalpine meadows are really alpine in origin.

KEYS.

The use of the usual key signs is very confusing. Instead of these marks the writer has for years used in private a system of letters and will adopt this in all keys hereafter. Parts of keys that are co-ordinate are represented by the same letter, as A., 2A., 3A., etc. Subordinate sections are represented by the next lower letter in the alphabet, combined with the first letter such as AB. Subordinate sections which are co-ordinate with each other are represented by AB., A2B., A3B., etc. The same method is used with sections that are subordinate to these, etc.

ALLIUM.

Flowers white to purple, never yellow, capsule from depressed-globose to obovate, often deeply lobed and with a spongy appendage on or near the top of each cell, called a crest; base of the style enclosed between the lobes of the ovary and jointed to its top, cells 1-2 ovuled at the base; filaments usually flat and dilated at the base; bracts, also called valves, 1-5, generally more or less united when young; leaves 1-several, fleshy, rarely leathery; scape from a several- to many-coated bulb, which, in a very few cases only, arises from the end of a rootstock, taste and smell that of strong onions; in all our species the leaves are sheathed at the base, the sheaths rising about to the surface of the ground, rarely above it, the bracts are never elongated beyond the flowers and the filaments are without teeth or points at the apex, the bases being united into a ring under the ovary, in our species. The following arrangement of species is based on what the author regards to be the genetic relationship, beginning with the lowest forms and ending with the highest. In a critical study of the onions, it is found that all but the very thinnest coats of the bulb are double and rarely triple, the main central coat having a very thin outer covering, which always, except perhaps in A. attenuifolium and possibly its allies and A. acuminatum, possesses rectangular markings arranged in vertical rows, the innermost portion of the coat, when present, generally has the same rectangular markings as the external portion of the main coat and is like it in texture; the main coat generally has peculiar markings which are characteristic of the species and of critical value in classification; all coats have several to many vertical ribs which branch only in the last section of the genus and mark the most highly developed species; coats often scabrous; occasionally, how-

ever, the markings are wholly absent. The floral characters, upon which much stress has been laid in classification, generally have but little value, the pedicels, filaments, and sepals being very variable in length and the crests of the ovary still more variable, running in some species from nothing to very long and even dissected. It is only when the sepals are very obtuse or very narrow and the filaments of unusual length that these characters seem to have much value in classification. Since the normal markings of the family are vertical ones and since a rootstock is less highly developed than a bulb, we take as the lowest species those having rootstocks at the ends of the bulbs and those having vertical markings on the bulb coats; we pass through those species having transverse markings to those having contorted markings with contorted walls, thence to those which have the same markings developed into oblique ribs and fibres. Nearly all our onions grow in soil which is moist in the spring, rarely are they found in wet meadows or boggy places. The species of this genus are entirely confined to the temperate zones.

A. Ribs of bulb coats not branching nor uniting into meshes, and so the bulbs are not fibrous coated, except A. madidum and fibrillum, which are minutely fibrous, but this latter is not caused by the union of ribs.

AB. Bulb coats few, with many ribs, not reticulated; bulbs lanceolate, tapering at tip, without rootstock, erect or nearly so, cross section of leaves round and hollow, and leaves several; peduncles not winged; no threads on the bulb-coats as they decay.

1. **A. Sibiricum** L. Mant. 562. Common name Chives. Closely allied to A. Schœnoprasum L. Scapes stout; umbel condensed and with very short pedicels; flowers bright rose-colored; sepals 4-5″ long; stamens not exserted; capsule not crested. This abounds from New Brunswick and northward to Alaska across the continent, and, though rare southward, it is found in the high mountains of northern Utah and Wyoming.

A2B. Bulb coats many, marked by about 16-20 delicate ribs (except perhaps in A. Brandegei) which rarely produce any branches at right angles to them; proper bulb very small; propagating by division of main bulb, which is 1-2′ long.

A2BC. Reticulation of bulb coat vertically-oblong or narrow, sometimes little wrinkles occur in the coat which appear like cross-ribs, coats very thin and delicate; bulbs with tapering and long apex; leaves several, straight, not thick nor leathery, arising from crown of the bulb.

A2BCD. Bulbs lanceolate in outline, about 2′ long (rarely 1′ long in A. brevistylum), with a thick central stem or stems arising from the crown which is conspicuously sheathed with white membranes and which bear several long, narrow, flat leaves which are barely acute; bulbs ascending, crowning a conspicuous rootstock; flowers on slender pedicels; top of peduncle thickened into a knot (which is not conspicuous in A. brevistylum) and peduncle flattened and winged; sepals gibbous at base; stems erect, 1-3° high; ribs of bulb-coats persisting as straight threads after the thin portion has perished; plants growing in wet meadows, mostly at high elevations and blooming in July.

A2BCDE. Flowers pink or purple, many; ovary obscurely if at all crested; sepals conspicuously acuminate.

2. **A. validum** Watson Bot. King 5 350 Rootstock gradually changing into a bulb and rooting on the under side; rootlets thick and coarse; ribs of bulb-coats about 16, extending to tip of the leaf; stems stout, often 6″ thick and sometimes 3° high and correspondingly winged; leaves 2-6″ wide, 1-2° long; flowers with conspicuously exserted stamens; filaments gradually widening toward the base; anthers nearly linear; sepals and pedicels short, bracts 2-4. very broadly ovate, acute. This grows in clumps in the high mountains of eastern Nevada to Oregon and California, in alpine meadows, around cold springs.

3. **A. brevistylum** Watson Bot. King 5 350. Rootstock

ending abruptly and crowned by one or more bulbs which root on the lower side and have many dead coats at base on the outside, they are also very much smaller than in A. validum, with stems about 1-2″ thick and not over 1½° high; peduncles obscurely winged; leaves about half as long as the stems, 6-10′ long, about 2″ wide, with 8-10 ribs; bract 1; pedicels about 1′ long; flowers about 4″ long; filaments deltoid at base and adnate nearly to the top of the broad portion; anthers very broadly-oblong, ½ the length of those in A. validum. This grows in the high mountains of Utah and northward to the Big Horn Mts., Wyoming, and in Montana. It is also found in Colorado.

A2BCD2E. Flowers few, white; capsule long-crested.

4. **A. Plummeræ** Watson Proc. A. A. 18 195. Bracts 2, long-acuminate, 1′ long, as long as the slender pedicels; sepals lanceolate, acute, 4″ long, longer than the stamens. This grows in Tanner's Canon, Huachuca Mts., S. Arizona.

A2BC2D. Bulbs with an ovate base and prolonged apex, the whole 2-4′ long, bulbs not arising from a rootstock, coats reddish; leaves about half as long as the peduncles, flat; stems slender, about 1-1½° high, not at all winged nor flattened except at the short clavate tip; stamens more or less exserted; flowers rose-colored, few to many, sepals about 2″ long; capsules crested; pedicels filiform; bulb rooting along the lower corner, and so is oblique, propagating by division into about two bulblets, which are produced at the crown of the roots and occupying the same sheath as the mother bulb; the shining body of the bulblet projects more or less below the mother bulb.

5 **A. cernuum** Roth. Roem. Arch. 1 pt. 3 40. Bulbs ascending, never quite erect, tip of new bulb barely projecting beyond the mother coat; alternate bulb coats thicker and all coats close together; leaves linear to narrowly so, 1-2″ wide; peduncles enlarged at very tip and hooked; pedicels very slender, about ½-1′ long; flowers bell-shaped to urn-shaped; sepals

broadly elliptical and barely acute; stamens long-exserted; filaments slender, not enlarged at base. This includes A. recurvatum Rydberg Fl. Mont. 94, which is described as having more slender peduncles, larger bracts, sepals with more distinct veins and narrower not keeled leaves with rounded cross section, not flattened, flowers brighter red; but the characters given do not hold at all. This grows mostly in the pine belt (Middle Temperate) regions of the mountains of Colorado and Utah, but is also found in Texas and throughout Southern British America to Alaska. It blooms in July.

A. Neo-Mexicanum Rydberg Torr. Bull. 26 541. Bulb crowning a more or less evident rhizoma ?; scape slender, round; leaves narrow, $\frac{1}{2}$ to $1\frac{1}{2}$" wide, almost flat; flowers 8-20, nodding; bracts very small; sepals oblong ovate, acute, nearly white, without midvein; stamens and style exserted. This appears to be a form of A. cernuum. Organ Mountains, New Mexico, also Arizona and south Colorado.

A. cernuum var. obtusum Cockerell, seems to be one of the usual forms of the species.

6. **A. haematochiton** Watson Proc. A. A. 14 227. Bulbs erect or ascending, clustered, coats sometimes 4' long, loose, generally brilliant-dark-purple as well as the shining bulblet at their base this sometimes projects its entire length below the mother coat, like a claw; leaves filiform, many; peduncles not hooked; pedicels not over 6" long, enlarged at tip; sepals almost acute to acuminate, open, broadly elliptical to lanceolate; stamens variable, filaments abruptly dilated at base, which is oblong and attached high up; capsule slightly if at all crested on the corners. This grows from the Sierras at Soda Springs, Nevada Co., California, to Mexico and blooms from April to July.

A. Californicum Rose Cont. Nat. Herb. 1 12. Leaves mostly shorter than the scape; bracts 2, ovate, acute; flowers 4-5, dark purple; pedicels 5-8" long; sepals lanceolate-acuminate; stamens included; probably is a form of the above. Lagoon Head, Lower Calif. Palmer.

A2B2C. Bulbs erect, or nearly so, generally a little oblique at

base, not conspicuously prolonged (somewhat so in some Douglasii forms and even 2′ long) about, or nearly 1′ long; coats normally white and shining, seldom red, rarely with any reticulation but the faint normal, vertical, rectangular ones, except A. anceps, Lemmoni, and parvum var. Brucæ; leaves 2, thick and leathery, hooked or conspicuously curved; peduncles flattened and more or less winged above, slender below and brittle, thickened at the bracts; flowers pink or purple; plants not over 1° high.

A2B2CD. Stamens not shorter than the sepals, except in A. anceps var. aberrans; valves very broad, often longer than the pedicels which are thickened above; with bulb coats not red, without transverse or special markings except in A. anceps; scapes low, shorter than the leaves, except in A. Hendersoni; sepals very narrow and slender, lanceolate in A. anceps var. aberrans, shorter, and ovate in A. Hendersoni, light purple, taper-pointed; capsule depressed-globose, nearly 3″ wide.

7. **A. platycaule** Wats. Proc. A. A. 14 234. Peduncles flat and wide, 3-4′ long; leaves conspicuously hooked, 4-12″ broad, longer than the peduncles; flowers very many, on slender, 4-8″-long pedicels; stamens conspicuously exserted, anthers triangular lanceolate, deeply notched at base; bracts 3-5; ovary not crested; sepals appearing scarcely wider than the filaments, except at base; bulb coats white; blooms in July; grows in rocky places in the high Sierras.

8. **A. anceps** Kell. Proc. Cal. Acad. 2 109. Peduncles 1-2″ wide above, narrowly winged, 3-4′ long; leaves about 2-3″ wide; bracts 2; pedicels slender, thickened above, about ½′ long, flowers less than 20; stamens about equaling the sepals, anthers often contracted in the middle; bulbs white and coats white, except at least one coat which is yellowish, thick and densely reticulated with fine, parallel, transversely and narrowly oblong, pointed meshes; capsule with 6, broad, obtuse crests; blooms in May along the eastern base of the Sierras at low elevations.

9. Var. **aberrans** n. var. Pedicels ½-1½' long; flowers 30-60; stamens two-thirds as long as the sepals; peduncles 6-8' long; sepals lanceolate-acuminate, 4" long; reticulations broader, bulb-coats thicker but not yellowish, outer bulb-coats brown; ovary crestless or only ridged, globose. This grows at Weiser, Idaho.

10. **A. Hendersoni** Rob. & Seat. Bot. Gaz. 18 237. Leaves about ½' wide; scape much exceeding the leaves, about one foot high; flowers many; valves 3; sepals rhombic-ovate at base, purple with light midribs; stamens exserted; ovary 6-crested. **Pullman, Wash. Blooms in May.**

A2B2C2D. Stamens shorter than the sepals; sepals never very narrow; bracts broad, 2; scapes generally shorter than the leaves; capsule not over 2" wide, globose. The species under this section are badly confused and are probably reducible to 2 or 3, since the characters are chiefly based upon the very variable capsule crests.

A2B2C2DE. Bulb coats without markings, except in A. parvum var. Brucæ.

11. **A. Douglasii** Hook. Fl. Bor. Am. 2 185. This cosmopolitan species is described as follows: Scape 8 10' high; flowers pale rose-colored, 3-4" long, segments lanceolate-acuminate, scarcely exceeding the stamens and style; ovary not at all crested. The pedicels vary from about 4" to 1' long and from slender to stout; the sepals are very variable in length and width and the stamens run from half to nearly the length of the sepals. Since Hooker considered this to differ but slightly from the well-known A. Tolmiei, and since the latter we know does not differ specifically from several other forms described below, we will take Douglasii as a type. This species grows generally in large patches in rocky places or even on clay banks in poor soil and the bulbs are often densely aggregated but none of them are bulbiferous but propagate by fission (division); they are frequently ascending. This onion is much used by Indians for food as the bulbs are large and edible, and has the character-

istic long underground sheathed stem of this group. This species is found chiefly from Southwestern Idaho and Oregon to British Columbia, but has been reported from Utah and Nevada. The following are the forms which have been described as species: **A. Cusickii** Wats. Proc. A. A. 14 228 is a form less than 6' high with lanceolate, broadly acuminate sepals nearly twice as long as the stamens, and ovary cells with a little point on each corner; Union County, Oregon. Also found on the Clearwater, central Idaho. **A. pleianthum** Wats. Proc. A. A. 14 232. This differs from A. Cusickii only in having the ovary conspicuously 6-crested and sepals gibbous at base. Has been found in Southern Idaho and Eastern Oregon. **A. Tolmiei** Baker Bot. Mag. 7 6227. This is also low, with the usual light purple to pink flowers with lanceolate sepals, acute, gibbous at base, half longer than stamens, and obscurely crested ovary. This is recorded from Parley's park, Utah, Southern Idaho, and Northward; probably also Western Utah and Nevada, Jones. Some of the Nevada forms have very narrow leaves 1-2" wide with 3, central, variable crests, much like A. falcifolium. The Nevada forms are probably **A. Brandegei.**

12. **A. crenulatum** Wiegand Torr. Bull. 26 135, t 355. Plants 3-4' high, from a small and globose bulb; scape winged $\frac{3}{4}$" wide, edges crenulately roughened as well as the leaves; leaves $2\frac{1}{2}$-3' long, $\frac{3}{4}$" wide, recurved; flowers few; sepals pink, 4" long, lanceolate, acutish; stamens $\frac{1}{2}$ the sepals; anthers short-oblong; ovary 6-crested at tip; pedicels shorter than the flowers: bracts 2, large, ovate, oblong, acute, 4-5" long. Said to be near **A. Douglasii. Olympic Mts., Wash.**

The following species are kept separate from A. Douglasii by Watson also, but there is nothing in the descriptions to warrant it. They are Breweri, falcifolium, parvum and Lemmoni; but are almost too closely related, though parvum will stand.

13. **A. Breweri** Wats. Proc. A. A. 14 233. This differs from Cusickii in having acute sepals one-third longer than the stamens, and ovary and capsule with a thick, slightly lobed

crest at the tip of each cell. Found on Mount Diablo, Western California.

14. **A. falcifolium** H. & A. Bot. Beech. 400. This differs from Cusickii in being about half as high, with attenuate and spreading sepals which are glandular serrulate, and capsule with 3, short, narrow, central crests. This is, probably, the only valid species and occurs in the Coast Range from Sonoma to Humboldt County, Calif.

15. **A. parvum** Kell. Proc. Cal. Acad. 3 54. Bulbs white, scales very thin, apparently not double, very base of scales sometimes with markings of var. Brucæ; scapes scarcely rising above the ground; bracts short, broadly ovate, not as long as pedicels, barely acute; flowers normally deep red; leaves very long and linear, about 1" wide; pedicels short and flowers almost capitate; sepals oblong, obtuse, always with a dark midrib, about 4" long; ovary with obscure crest-like ridges. Common on the Eastern side of the Sierras in the vicinity of Reno, Nevada. April and May.

16. Var. **Brucae** n. var. Leaf 1, sheathing; pedicels 4-6" long; sepals paler, 4" long; ovary crestless; filaments two-thirds the sepals, broad and flattened below, tapering; bracts sharply acute; outer bulb scales distinctly marked with the meshes of A. tribracteatum nearly, but vertical instead of horizontal. No. 1907, Yankee Hill, Butte County, Calif., April, 1897, Mrs. C. C. Bruce.

A2B2C2D2E. Bulb coats with horizontally oblong reticulations, which run from nearly hexagonal to transversely linear.

17. **A. Lemmoni** Wats. Proc. A. A. 14 234, differs from A. Cusickii only in segments being ovate-lanceolate, gibbous, a little longer than the stamens; ovary cells with broad, obscure crests on each side and reticulated bulb scales. Found in the Sierras. To this probably belong the specimens collected by the writer at Eagle Lake, north of Susanville, Calif., No. 6666, in

which the scape is about 1° high; bulbs propagate by division; lower end of some bulb scales with the markings of A. Brandegei; leaves shorter than the stems, 1-2" wide; pedicels about 1' long; sepals from ovate to lanceolate-acuminate; stamens nearly equaling the sepals; ovary not at all crested. This is manifestly very close to A. anceps.

18. **A. Brandegei** Wats. Proc. A. A. 17 380. Peduncles very short, rising but little above the ground, slightly winged, bulbs ovate, markings of some of the outer coats vary on the same bulb from transversely linear to openly and almost regularly hexagonal, one of the coats generally thick like A. anceps; leaves rather narrow, about 2" wide; pedicels short, slender, about 4" long; flowers purplish; sepals broadly lanceolate, acute, 3-4" long, nearly double the stamens, but variable to oblong and obtuse. A. miser Piper is the same with obtuse sepals. Gathered by Brandegee on the Elk Mts., Colo. First collected by Cleburn many years ago at Boise City, Idaho: also by Cusick in Malheur County, Oregon.

13B. Pedunceles not winged; bulb coats several to many, marked by 8-12 delicate ribs which do not branch; the bulbs often solid within the coats and generally more than half of the whole, propagating variously, orate to spherical, generally small, erect, never from a rootstock; bulb coats none of them fibrous-meshed nor becoming a mass of interwoven, coarse threads with diamond-shaped meshes when old.

13BC. Reticulations of the bulb coats vertically oblong or narrower, in many rows, walls not finely contorted, generally straight; bracts 2, rarely 3 in A. ambiguum; sepals not serrulate; outer bulb coats dark or reddish; flowers rose-colored; pedicels 2-9" long, slender, except in A. Bigelovii; leaves 2 or more, not surpassing the scape.

19. **A. scaposum** Benth. Ovary obscurely, if at all, 3-crested; pedunceles 1 or more high; reticulations linear, straight and

coarse; flowers rather few, loose; stamens included; sepals lanceolate-acuminate, 3-4″ long, midvein only red. This may be A. Kunthii Don., which is Schœnoprasum lineare HBK. Southern and western Texas to southern Arizona and southern Tropical zone.

20. **A. stellatum** Fraser, Ker. Bot. Mag. t 1576. Outer bulb coats reddish; peduncles rather tall; ovary 6-crested; reticulations very fine and close, linear, sepals 2-3″ long; bracts acute; stamens exserted. Western edge of the plains from the Saskatchewan to Iowa in the Oak Belt, and reported in northwestern Texas.

21. **A. Bigelovii** Wats. King's Rep. 5 487. Peduncles not over 6′ high; reticulations vertically oblong, broad; pedicels stout; sepals oblong-lanceolate, acute, 4-6″ long; crests conspicuous. Arizona and New Mexico.

A3B2C. Reticulations transversely oblong, hexagonal or absent, walls not at all sinuous nor beaded, except some of the horizontal lines have a few waves in the species from A. attenuifolium to A. peninsulare, probably.

A3B2CD. Special reticulations absent or unknown.

A3B2CDE. Leaves not longer than the peduncles; peduncles not over 6′ high; sepals acute, except in A. scilloides, not over 4″ long.

A3B2CDEF. Leaves 2; *reticulations unknown.*

A3B2CDEFG. Ovary not crested, or obscurely so.

22. **A. scilloides** Dougl. Wats. Proc. A. A. 14 229. Sepals oblong-lanceolate, obtuse, 3″ long, half longer than the stamens; ovary crestless. Columbia river, Oregon.

23. **A. collinum** Dougl. Sepals ovate-lanceolate, acute, 4″ long, double the slender stamens; capsule obscurely ridged at the summit. Said to be abundant on the Blue Mts., Oregon. An obscure species.

A3B2CDEF2G. Peduncles 3-5' high; ovary prominently crested; filaments filiform not dilated below, except at disk; flowers colored; sepals acute, longer than the stamens.

24. **A. campanulatum** Wats. Proc. A. A. 14 231. Umbels somewhat nodding, many flowered; pedicels slender, from $\frac{1}{3}$-$1\frac{1}{4}$' long; flowers rather bell-shaped; sepals broadly ovate-lanceolate, acute to short-acuminate, 4'' long, one-third longer than the stamens. Sierra Nevadas, Mariposa to Plumas Counties, Calif. See No. 52.

25. **A. Bidwelliae** Wats. Proc. A. A. 14 231. Peduncles not over 3' high; flowers rather few; pedicels 6'' long; sepals narrowly lanceolate, acuminate, about 3'' long, stamens nearly equaling them. Sierras, above Chico, Calif. May.

A3B2CDE2F. Leaf 1, narrow; bulbs red, brownish in A. cristatum, ovate to nearly round, about 9'' long; flowers many, bracts 2, rarely more, ovate, acuminate, shorter than the widely spreading pedicels; sepals acuminate; plants about 6' high.

A3B2CDE2FG. Pedicels 6-9'' long, slender.

26. **A. Parryi** Wats. Proc. A. A. 14 231. Bulb coats rather thick and stiff, inclined to be dull, few, outer part of coats with rectangular and vertical, faint reticulations, rather prominent by reflected light; bulbs propagate by cracking open at the bottom, but apparently do not produce bulblets there nor runners; slender plants; leaves not coiled; stigma 3-cleft with linear lobes; sepals rose-colored, lanceolate, half to a third longer than the stamens, about 3'' long; crests entire to notched. Seeds triangular, obovate, pitted but not ribbed, black. San Bernardino Mts., southern Calif. June. (For A. Parishii, which probably belongs here, see No. 39.)

27. **A. atrorubens** Wats. King's Rep. 5 352. Bulb coats about 7, rather thin and shining, without markings except at base

where the meshes are vertical, narrow or rectangluar; sepals rather lead-purple, narrowly lanceolate, 4-5" long, rather stiff; ovary lacerate-crested; stamens about two-thirds the sepals; bulbs propagate by the production of brilliant, shiny bulblets at the base, which point downward and outward and often produce short runners at their apex, having 1 or more enlargements along them and so forming a string of shiny bulblets; scapes not slender, a few inches high, strict; leaves coiled at tip; grows in the Oak Belt on the east side of the Sierras, Carson City to Owen's Valley. May to June.

A3B2CDE2F2G. Pedicels 3-5" long; crests conspicuously fimbriate and very long, glandular toothed in A. cristatum.

28. **A. fimbriatum** Wats. Proc. A. A. 14 232. Bulb unknown; peduncles 3' long; pedicels 3-4" long; flowers deep rose-colored, 5" long; sepals lanceolate, nearly half longer than the stamens; stigma 3-cleft with linear lobes; bracts probably 2; southern Calif., on the Mojave river.

29. **A. decipiens** n. sp. Plants about 2' above the ground; leaf long-sheathing, probably longer than the peduncles; bracts 4, ovate, equaling the pedicels, which are about 4-5" long; sepals ovate-lanceolate, 4" long, a little exceeding the stamens; stigma entire; bulb nearly round, coats shining, without reticulation in the middle, but with traces of rectangular-oblong ones toward the base and apex, which are vertically arranged, all the coats thin. Summit, Owen's Valley, Calif., 7,000° elevation. May, 1897.

30. **A. cristatum** Wats. Proc. A. A. 14 232. Peduncles about 1-3' high; bulb coats brownish, with very faint quadrangular reticulation; bracts acuminate; pedicels 3-4" long; sepals tinged with red, 5" long, lanceolate-acuminate, nearly double the stamens; crests very long, acute, somewhat glandular toothed. Southern Utah at St. George.

A3B2CD2E. Leaves 1 or 2, longer than the peduncle; ovary long-crested; very low and small plants, a few inches high and slender.

31. **A. macrum** Wats. Proc. A. A. 14 233. Leaves 2, distinctly sheathing; peduncles 1-4' high; bracts 2, acute; slender pedicels 2-3'' long; sepals white or purplish, 2-3'' long, narrowly lanceolate-acuminate, scarcely exceeding the stamens; cells of the ovary with thick, obtuse crests at the summit. This plant cannot be separated from A. madidum except by markings of scales. Probably is the same as A. Nevii Watson. Union Co., Oregon, on rocky hills, Cusick.

A3B2C2D. Reticulations evident, walls of reticulations not minutely sinuous, except in A. attenuifolium to A. Bolanderi probably, in which some of the horizontal lines have a few waves; peduncles slender, filaments deltoid-dilated at base; bulbs propagating by division.

A3B2C2DE. Reticulations transversely oblong to linear; straight or nearly so; peduncles a few inches high; leaves longer than the peduncle.

A3B2C2DEF. Leaves 2, rarely 1 *in A. tribracteatum; bulb coats mostly red, rarely white, thin, ends of reticulations pointed; pedicels slender; crests not large; sepals about* 3'' *long, acute, longer than the stamens.*

32. **A. Nevii** Wats. Proc. A. A. 14 231. Peduncles 6-8' high, pedicels rather few, 4-6'' long; sepals white to rose-colored, lanceolate-acuminate, a little longer than the stamens; cells of the ovary with a thick, short crest on each side near the top; bracts 2. Hood river, Ore., also the southern Blue Mts., Cusick, No. 1642. Blooms in May. This is probably a synonym of A. madidum.

33. **A. tribracteatum** Torr. Pac. R. R. 4 148. Leaves sometimes 1, in the type greatly exceeding the very stout peduncle; capsule obscurely, if at all, crested; leaves 3'' broad or less, flat and grass like; peduncles 1-2' high; bracts 3, long-acuminate; pedicels 2-3'' long; sepals with dark midvein, narrowly oblong-lanceolate, acutish, little longer than the stamens. Alpine in

the Sierra Nevadas, Mono to Nevada Co., Calif. Reported from Steamboat Springs, Colorado, but probably an error.

34. Var. **Diehlii** n. var. Bracts 2; leaves from double to a third longer than the peduncles, 4-6' long, 2" wide; pedicels 4-8" long, many; flowers white with brown midrib; outermost bulb coats very dark-red normally, rarely white; sepals erect, not spreading, ovate-lanceolate to lanceolate-acuminate, the inner ones narrower, half longer than the stamens; filaments narrowly deltoid at base and adherent to sepals; reticulations normally short-oblong to even linear-oblong and closely packed, but among these cells there are often irregular ones, which are sometimes as broad as long; bracts shortly acuminate, about 6" long; ovary spongy- and sulcate-crested, the crests not evident in fruit; bulbs nearly spherical, about 6" long, the coats generally all dark red. No. 6590, Jones. Collected at Altus, Utah, 8,000° altitude, in the upper edge of the Oak Belt, blooming in May.

A3B2C2DE2F. Reticulations nearly rectangular, leaves solitary, longer than the scape; scapes not over 6' high; pedicels short.

A3B2C2DE2FG. Capsule not crested; very small and delicate plants growing at high elevations.

35. **A. ambiguum** n. sp. Leaf 1, 1-3" wide, not falcate, flat; bracts rarely 3, about 4" long, broadly ovate and triangular-acuminate; pedicels 2-4" long; flowers more than 10; 3" long, oblong-bell-shaped; sepals elliptic-lanceolate, obtuse, with a broad, brown-purple midrib and white margins, half longer than the filiform filaments, 3" long; bulbs oval-ovate, 6" long, with thin membranous coats, at least one of the coats in the type specimens verdigris-colored, coats about 5, rest of bulb solid and corm-like, the outer ones marked with prominent, normally 6-sided meshes, which run from nearly square to hexagonal or horizontally oblong-diamond-shaped in the middle of coat but vertical elsewhere. This was found growing on alpine ridges at Summit, Calif., in bloom July 26, 1900. This may be related to

A. obtusum Lem., but if that species is correctly described, this differs in having 2 bracts instead of 3, crestless capsules, and has regularly not the slightest resemblance to A. Nevadense or A. tribracteatum.

36. **A. minimum** n. sp. The most delicate of all the onions; leaves and peduncles almost filiform, the former 3-4' long, the latter rising barely above the ground; leaves 2; bracts ovate, acute, 3'' long, 2; pedicels barely 2'' long; flowers less than 10, broadly bell-shaped, 2'' long, red tipped, white and hyaline and green-nerved below, sepals ovate, broad, barely acute; filaments flattened but not much larger below, half as long as the sepals; ovary depressed-globose; bulbs small, about 4'' long, ovate to oval, normally with a thick, red inner coat which is prominently marked, rarely white throughout, the other coats very thin and membranous, in all about 5, markings nearly rectangular with rather irregular sides, from square to broadly oblong. Alpine summits of Cuddy mountains, Idaho, July 2, 1899.

37. **A. simillimum** Henderson Torr. Bull. 27 355. Scapes 1-1½' long, slender, flat and narrowly winged; bulb ovate, 4-6'' long, loosely covered with the membranous coats; reticulations long-rectangular above, then square, then wider than long and meshes 5-7-sided; leaves 2, about ½'' wide, 3-4' long, falcate to recurved; bracts 2, broadly ovate; acute to acutish; flowers 6-9, 2½-3'' long, on slender pedicels 1-1½'' long; sepals narrowly oblong, obtuse, delicately denticulate below with spreading papillæ, purplish-white, with strong and green midnerve; stamens ½-⅔ the sepals, filaments widened below and attached ⅓ the way up; anthers oblong-oval; ovary slightly crested. Seceh Peak, near Payette Lake, Idaho, July 2, 1895. This is near to A. minimum but differs in the flattened and winged scape, slender pedicels, crested ovary, and papillate-ciliate and narrow sepals. It has the same habit.

A3B2C2DE2F2G. Capsule distinctly crested.

38. **A. obtusum** Lemmon Pitt 2 69. Scapes 2-3' high, slender; whole plant rose-colored; leaf 2-3'' broad, usually falcate;

bracts 3, oblong-elliptical, acuminate, about as long as the pedicels, which are 2-4'' long; sepals oblong, obtuse, with broad, greenish midrib; crests 6, short, acute; said to be near A. Nevadense and A. tribracteatum, but these species have nothing in common. Said to be rare in the sub-alpine region of Gold lake, Plumas Co., Calif., June 26, 1889.

39. **A. Parishii** Wats. Proc. A. A. 17 381. Bulbs with reddish-brown coats without reticulations, or with minute, short, oblong meshes; scape rather stout, 4-6' high; bracts 2, broadly ovate; pedicels few, short and stout, sepals rose-colored, 6-8'' long, thrice the stamens, acuminate; filaments flat and tapering; crests prominent, acutish, irregularly toothed; stigma somewhat lobed. Mojave desert at Cushenberg spring, Parish, May, 1882. This is doubtless very closely allied to A. Paryi and should probably be placed next to it.

A3B2C2D2E. Reticulations transversely linear, or nearly so, their general direction mostly oblique; bent in the middle or contorted, in two of the species some of the meshes are quite irregular and often broader, but narrow meshes can always be found on every coat.

A3B2C2D2EF. Leaves 2 or more, shorter than the peduncle, except in A. madidum and fibrillum, very narrowly linear, taper-pointed; bracts 2; rarely 3; plants from 4-12′ high; flowers mostly white.

A3B2C2D2EFG. Reticulations horizontally serrate, the sides parallel.

40. **A. serratum** Wats. King's Rep. 5 487. Markings of bulb coats with the meshes linear and bent only in the middle; leaves very narrow; bracts narrowly acuminate; sepals 4-6'' long, rose-colored, broadly ovate-lanceolate, acute to acuminate, rather rigid and straight, the inner somewhat serrulate; filaments gradually tapering to a deltoid base and attached for half the length; crests very narrow and central. Has the

habit of A. acuminatum. Coast ranges of Calif. and foothills of the Sierra Nevadas; San Diego to Marin Co.

The following are probably forms of the same: **A. crispum** Greene, Pitt. 1 166. Bracts 2, abruptly acute; pedicels 12-20. about 1' long, stoutish; sepals 3-4" long, the outer oblong-ovate, entire, the inner lanceolate with undulate margins; stamens a little over half the sepals; ovary not crested; San Luis Obispo Co., Calif.; April. **A. dichlamydeum** Greene, Pitt. 1 166; a smaller plant with sepals 5" long, the outer oblong, abruptly acute and spreading, the inner lanceolate-oblong, erect, all entire; ovary crested; common around San Francisco in May and June. **A. stenanthum** Drew, appears to be identical with A. serratum; was gathered at Pilot Ridge, Calif., in July.

41. **A. attenuifolium** Kellogg, Proc. Cal. Acad. 2 110. Reticulations composed of delicate lines, at least the vertical ones very sinuous, the horizontal lines generally somewhat wavy, the meshes being more horizontally sinuous than serrate, the meshes are quite variable in different plants, some of them being broadly oblong and a little bent with the vertical lines very sinuous as figured by Watson. These markings toward the tip of the coat turn into rectangular, vertically oblong ones without sinuosity, they occur on the thin coats, but the thick coats generally have transversely linear meshes with the horizontal lines distinctly wavy; the bulb coats are of two kinds, the outer 1 or 2 coats being very thin and white, an inner one or more being quite rigid and deep red; bulbs propagate by division and are small and nearly round, the solid part large and scales few; leaves and bracts two or more, the latter very broad and short; pedicels very slender, weak and generally sinuous; flowers broadly campanulate, about 2-4" long, very delicate and thin, rose-colored to white; sepals ovate to lanceolate and acute; stems nearly 1° high or more; crests conspicuous, composed of broad ridges running from the style to the corner where they are enlarged and, on the mature capsule, look like horns. Mariposa Co., Calif., to Ore. Quite variable.

42. **A. hyalinum** Curran Proc. A. A. 24 87, Bull. Cal. Acad. 3 155. Bulb coats gray, meshes narrowly linear and much contorted; leaves several; peduncles about 1° high; the 2 bracts not opening below except on one side; pedicels rather few, about 1' long; sepals broad, 2-4½" long, acute, broadly lanceolate to ovate, inner somewhat narrower, half longer than the stamens; ovary said to be not crested. Eldorado Co., Calif., to Encenada, Lower Calif. This may be only a delicate form of A. attenuifolium, and reticulations of the bulb coats are nearly the same, except the little waves of the latter on the horizontal lines.

43. **A. Bolanderi** Wats. Proc. A. A. 14 229. Bulbs solid in the center, with a few outer coats, propagating by 1 or 2 very short lateral offshoots, the coats with delicate, close, undulate-serrate meshes; pedicels rather few; sepals colored, 4-5" long, very narrowly acuminate, nearly straight, double the stamens, inner ones strongly serrate; filaments narrow and adnate to the middle of the sepals; crests obscure. Humboldt Co., Calif.

A3B2C2D2EF2G. Reticulations not horizontal but running obliquely downward or irregularly, sides not evidently parallel, though approaching it, wavy or bent in irregular arcs but not bent into many tortuous curves, generally bent in irregular arcs which toward the end of the meshes change their direction, most of the meshes being narrowly oblong in general outline.

44. **A. peninsulare** Lemmon Pitt. 1 165. Tall, about 1-1½° high; pedicels about 1' long and slender; bracts 2, narrow and acuminate; flowers broadly campanulate; sepals ovate, acutish, about 3" long, about half longer than the stamens, pink; capsule crestless; bulb coats several, at the top the meshes are narrowly rectangular and vertical but as they go down to the center of the coat they become loose and more irregular, till most of them are transversely serrate with narrow meshes. Encenada, Lower Calif. A. W. Anthony No. 187, also by Parish No. 72. Bulbs propagating apparently by division, nearly globular, about ½' long, erect. This is referred at Cambridge to

A. campanulatum but is quite different from what the writer supposes is that plant.

45. **A. madidum** Wats. Proc. A. A. 14 228. Delicate plants about 4' high; bulbs close to the surface, ovate, less than 6'' long, oblique, ascending, propagating by many little purple bulblets clustered around the base, which are without stalks; coats few and thin, reticulations narrowly oblong above and quite irregular and diamond-shaped to irregular lower down, but in the middle of the coat they are much contorted and about the same as in the following species, except that the outer coats are not so conspicuously fibrous as they decay; leaves 2, about as long as the peduncles; bracts 2, very broadly ovate and acute; flowering pedicels concealed within the bracts, fruiting pedicels about 4'' long; flowers white or nearly so; sepals oblong-ovate and barely acute to oblong-lanceolate and acute, 2-3'' long; stamens a little over half the sepals; ovary crestless when dry, but fresh specimens from Cusick, No. 2511a, have the edge of each cell from near the base to tip covered with a broad, raised, spongy, flat-topped crest which runs around the entire cell the same as in A. tribracteatum var. Diehlii. This species was confused with A. Douglasii by Watson for the leaf characters were drawn from that species and also the scape as well as a part of the bulb character. This has also been distributed by Mr. Cusick as A. macrum and collinum, and can be separated from them with difficulty. It grows in wet places in eastern Oregon, in small clusters, and blooms in May and June.

46. **A. collinum** Dougl. Wats. Proc. A. A. 14 228. Slender and delicate plants, like the last in leaves, scape, color of flowers, pedicels, bracts, ovary and stamens; the outer sepals ovate and acute, about 2'' long, the inner lanceolate and much narrower; bulbs nearly spherical, without bulblets, propagating by division, with several very thin coats which appear as if fibrous because the walls of the meshes have lost the hyaline interspaces, but meshes not diamond-shaped; reticulations very fine and very narrow, very much contorted and appearing as if in nests, the

ends of several of them coming together in short wavy lines. Growing at high elevations in gumbo soil in the Cuddy mountains, Idaho, July, 1899, No. 6650, Jones; also No. 2413, Cusick, probably. It is hardly probable that either Watson or Douglas would have overlooked the conspicuous bulb coats of this plant, it is therefore more than likely that this is a distinct speciesand in that case may bear the name of **A. fibrillum** n. sp.

A3B2C2D2E2F. Leaf 1, very much longer than the scape and spirally hooked at the end; bulbs propagating by the production of little half-moon-shaped to ovate, nearly white, bulblets from the lower edge, which often have little runners with 1 or more enlargements at short distances apart.

47. **A. Nevadense** Wats. King's Rep. 5 351. Coats many, bulb ovate, about 9" long, with several brown coats, having much the habit of A. atrorubens, but flowers generally white or rose-colored; peduncle scarcely rising above the ground; leaves often 6' long, leathery, but always narrow; bracts generally 2, ovate and acute, about 6" long; pedicels 1' or less in length; sepals lanceolate from a broad base and long acuminate to oblong-ovate and acute, 3-4" long; stamens two-thirds the sepals, deltoid-dilated at base; ovary very long-crested; reticulations of the bulb coats very irregular, from linear and almost straight to several angled, the vertical lines which join the ends of the cells are easily traceable in contorted lines running vertically, except rarely in the middle of some coats. Common from northern Arizona through the Sevier valley of Utah to Salt Lake city and westward to the Sierra Nevadas. Blooms in May.

A3B3C. Reticulations from transversely rectangular to very irregular, the walls always minutely to conspicuously scroll-like between the angles of the meshes.

A3B3CD. General outline of meshes nearly rectangular; plants a few inches high; leaves 2; bracts 2; filaments deltoid at base; flowers rose-colored to nearly white; sepals 3-5" long,

acuminate, a little longer than the stamens; peduncles single; bulbs white.

48. **A. Palmeri** Wats. King's Rep. 5 487. Outlines of the cells nearly quadrangular, short oblong, to even vertically oblong occasionally but always with most of the cells transverse; the walls very minutely sinuous; sepals ovate-lanceolate; filaments with a broad deltoid base; crests thin and conspicuous; bulb coats rather thin, probably propagating by bulblets. Grows at lower elevations than A. bisceptrum, but probably varies into it. Southern Utah and Arizona to N. M.

49. **A. lacunosum** Wats. Proc. A. A. 14 231. Bulb coats thick, distinctly pitted by the nearly square to oblong reticulations; flowers rather few; pedicels not over 5'' long; sepals not over 4'' long and oblanceolate; filaments narrowly deltoid at base; ovary with obtuse, thickened ridges toward the top of each cell. Santa Clara Co., Calif, on the Coast range at Mariposa Peak.

A3B3C2D. General outline of the meshes hexagonal, there being 1 main, thick, outer coat, which is deeply pitted by the walls being much raised and, with a small magnifier, appear to have flat-topped walls and which on the inner side of the same coat are depressed. This coat is triple, having a thin, hyaline membrane on both sides of the thick central one, the outer membrane has much contorted markings like those of A. Nevadense nearly, the inner has single or double and nearly rectangular markings; meshes twice the size of any other onion in section A.

50. **A. acuminatum** Hooker Fl. B. A. 2 184. Walls of the meshes under a moderate power appear beaded, but when magnified more are minutely sinuous; pedicels 6-12'' long; flowers deep rose-colored, rigid, with recurved tips, 4-7'' long; sepals lanceolate-acuminate, a third longer than the stamens, the inner ones undulate serrulate; filaments slightly enlarged below, ovary with six, rounded, contiguous, mammillary crests when fresh which do not exceed one-half the height of ovary; plants generally

about 6-12' high, growing in clumps at low elevations; leaves nearly equaling the peduncle; bulbs propagating by division, nearly spherical, about 6" long; sepals very variable, but always with at least a short acuminate tip. This is the most common of all the far western onions, abounding throughout Utah, Nev., parts of Idaho to Wash. and Calif. Blooms in May.

Var. **cuspidatum** Fernald is simply a form with short and abruptly acuminate sepals, it is hardly worthy of varietal rank.

A3B3C3D. General outline of meshes decidedly irregular or wavy; leaves 2 or more; bracts 2 (rarely 3 in A. campanulatum); ovary distinctly 6-crested; sepals entire, about 3" long, rather lax, (somewhat stiff in A. campanulatum), acute; bulb coats white; plants about 1° high, but sometimes lower in A. campanulatum; flowers many; pedicels slender and rather long.

A3B3C3DE. Stamens exserted.

51. **A. Sanbornii** Wood Proc. Phil. Acad, 1868 171. Reticulations very minute and irregular; bracts 4; sepals ovate-lanceolate; capsule very thin. Yuba to Mariposa Co., California, in the mountains.

A3B3C3D2E. Stamens not exserted; vertical walls of the meshes very deeply crimped, the sinuosities being almost as deep as the width of the meshes, very many and conspicuous; bracts 2, ovate or rarely lanceolate, about 6-9" long, scarcely as long as the pedicels; sepals ovate to lanceolate, shortly acuminate, about 3" long, with prominent midvein; bulbs nearly spherical, about 6" long, propagating by little runners which are sometimes 4' long and have bulblets at the ends; horizontal walls of the meshes generally barely sinuous or nearly straight, except toward the base of the coats; leaves 2, rarely 3, about as long as the peduncle, flat, narrow; pedicels widely spreading.

52. **A. campanulatum** Wats. Proc. A. A. 14 231. Rather slender plants, 4-12' high; peduncles single; flowers about lead

purple; sepals from rarely to conspicuously acuminate, spreading, midrib dark; ovary globular, with prominent central crests; leaves very narrow (except in very young plants) and probably longer than the peduncle; bulb coats brownish, never pure white, crimpings of the vertical walls of the meshes very deep and not conspicuously different on the upper end of the coats; ribs about 8; bulblets often purple. This grows in the high Sierras of California in Nevada and Plumas Cos. This is what the writer takes to be the true A. campanulatum.

53. **A. bisceptrum** Wats. King's Rep. 5 351. Plants rarely less than 1° high, normally about 1½° high, quite succulent; leaves broad when fresh, often 3" wide, taper-pointed; stems often 2 to each bulb; bracts very broadly ovate and very delicate; flowers white to light-pink; sepals without prominent midveins scarcely at all acuminate, mostly broadly lanceolate, little spreading; crests on the angles, prominent; bulb coats white or nearly so, about 12 ribbed, rarely pink or some of the outer coats brownish, meshes very minutely sinuous, less coarse and much shorter than in A. campanulatum, but very variable, as they approach the top of the coat they become more uniform until they are regularly, narrowly, and vertically oblong and with rectangular angles and with walls simply beaded, these latter meshes vary from quite wide to very narrow. The Nevada forms which represent the type of the species have dark flowers even with a tinge of lead-color, the leaves are normally 2" wide though wider ones occur, but both forms exist in Utah. This onion abounds in the shade, on moist slopes, in the Oak Belt, and is found throughout central and northern Utah and Nevada to the Sierras. This hardly differs specifically from A. Palmeri. It blooms in June.

2A. *Ribs (not over 11) of the many bulb coats short, branched throughout and united into coarse, diamond-shaped, regular and very large meshes; bulb coats soon breaking up into coarse, thread-like ribs at the top, losing the membranous covering, and becoming a mass of interlaced fibres;*

bulbs without a rhizoma or rootstock, erect or nearly so, propagating by division only (by the production of little nipples on the lower corners which soon turn into divisions of the main bulb), ovate, 1' or more long and with a rather prolonged apex, proper bulb very small within the coats; peduncles not winged.

2AB. Pedicels slender, about 1' long and evidently sinuous: generally bearing bulbs instead of some or all of the flowers; slender and tall plants, 1-2° high, when fully developed; outer bulb coats conspicuously and coarsely fibrous.

54. **A. Geyeri** Wats. Proc. A. A. 14 227. Flowers in the type 4'' long, the sepals broad, acute or acuminate, strongly nerved or rigid in fruit; bracts 2. rather small; capsule conspicuously and centrally crested. Idaho to Oregon and northward. A. fibrosum Rydberg, seems to be identical with the type of A. Geyeri.

55. Var. **tenerum** n. var., is a very slender form, about 2° high with elliptical and acute bulblets, about 2'' long and very pale and delicate; flowers with oblong-ovate sepals less than 3'' long, not rigid; grows in very wet and boggy places in alpine meadows, Deer Lake, Washington Co , Idaho, in July. No. 6597 also grows in the Wallowa Mts., Oregon, and probably is identical with Watson's 1181 from Bear River valley, Wyoming, near Evanston.

56. **A. Canadense** L. Sp. 1195. Flowers about 3'' long; sepals narrowly lanceolate, obtusish; bracts generally 3; capsule without crests; bulb coats apparently triple, the inner membrane having the markings of A. cernuum, the outer one with prominent hexagonal meshes like those of A. acuminatum but the walls neither beaded nor raised, the middle membrane is thick and fibrous; bulblets ovate and fully 3'' long; stems rather stout. This abounds from Canada to the Gulf of Mexico and westward to the Rocky Mountains.

A. rubrum Osterhout Torr. Bull. 27 506. Scapes 1½-2° high, round, smooth, glaucous, longer than the leaves; leaves about 4,

3½" wide or less, concave; bracts 3; flowers 3-4, sepals 3-3½" long, 2" wide, narrowly ovate, obtuse, the outer ones dark-veined; pedicels 5" long; filaments as long as the sepals; bulblets red; ovary not crested. This appears to be a form of A. Canadense. Found on the Colorado-Wyoming line.

A. sabulicola Osterhout Torr. Bull. 27 539. Scapes 8-12' high, round, smooth, tapering, shorter than the leaves; leaves slender, 2½" wide, concave; bracts 2, acuminate; flowers several; sepals ovate acuminate, 4½" long, 2½" wide, with recurved tip; filaments as long as the sepals; ovary not crested; bulblets whitish; pedicels rather stout, 3½-5" long. Probably a form of A. Canadense. Chama, New Mexico.

2A2B. Pedicels not evidently sinuous, mostly stout, seldom more than 9" long, often less; plants rarely if ever bulbiferous. These plants probably all belong to one species. Stems rather low, rarely 1° high.

57. **A. mutabile** Michx. Fl. 1 195. Bulbs coarsely fibrous; capsules crestless; leaves usually 3, about 2" broad, flat, shorter than the peduncle; flowers light-colored, 2-4" long; sepals thin and lax in fruit, ovate to narrowly lanceolate, obtuse to acutish. From North Carolina, Nebraska, New Mexico and southward.

A. arenicola Small Torr. Bull. 27 276. Pedicels 3-5" long, slender; flowers 10-30, deep-pink; sepals linear to narrowly lanceolate, 2" long, very delicate; filaments dilated at base; capsule not crested. This is probably a slender form of A. mutabile. Brockhaven, Miss.

58. **A. Nuttallii** Wats. Proc. A. A. 14 227. Bulbs small, little over 6" long; peduncles about 6' high; sepals about 3" long (in mine 2" long), ovate to ovate-lanceolate, rather rigid and acute, often red; capsule not crested; leaves very narrow; bulb coats rather chestnut-brown, with very dense and fine meshes which split up into threads on their upper edge, but below generally remain solid. This seems to have been confused with A. reticulatum or else passes into it by insensible gradation. Kansas to Colorado and southward.

59. **A. reticulatum** Fraser Don. Mem. Wern. Soc. 6 36.

(Named by Fraser but first published by Don). Capsule distinctly and centrally crested in the type; bracts 2; pedicels about 6" long; bulbs large, generally; leaves nearly 2" wide. A very variable plant, as generally understood; mountain forms are slender and the sepals very variable, the crests being always small and central. From the Saskatchewan to northern Arizona, throughout Colorado.

60. Var. **deserticola** n. var. Stout and robust plants, rarely over 6' high; leaves surpassing the stems; bulbs often 2' long and 1' thick, very densely and coarsely fibrous; pedicels stout; sepals oblong and acute mostly, about 3" long; crests very long and conspicuous; bracts 3. This abounds on the adobe plains of eastern Utah, south of the Uintas and western Colorado and southward to Texas. Blooms in May and June.

Note—The following onions are unknown to the writer: **A. unifolium** Kel. has the bulb an ovate coated corm, probably belonging to the A. bisceptrum group, but which is said to propagate by an offshoot from the lower part of a tall stem; it has several narrow leaves, two bracts, crestless capsules, deep-seated, white bulbs, bulb coat with a close contorted reticulation, bright rose-colored flowers, 5-7" long on pedicels over 1' long, the ovate-lanceolate, acute sepals exceeding the stamens; this is found throughout the Coast range of California.

A. monospermum Jepson Man. Bay Region 321, and **A. Alleghenense** Small are also unknown to the writer.

The other species, **A. tricoccum** Ait. Hort. Kew 1 428, belongs to a distinct group, which is closely allied to the A. validum group and is characterized by having rootstocks beneath the cæspitose bulbs, also the usual membranous coats of that group; valves 2; peduncles not winged; leaves 2 or 3, elliptical-lanceolate; ovules solitary in the cells; bulb coats fleshy, the outer becoming fibrous; plants 4-12' high; flowers greenish white; sepals 2-3" long; capsule not crested. New England to Wisconsin, and south to Kentucky and North Carolina.

ADDENDA.

A. pleianthum Var. **particolor** n. var. The Nevada forms on which this variety is based have scapes 1-2' above the ground, flattened above, not over 1" wide, erect, dark-purple or brown as well as the pedicels, and midrib of the flowers and bracts; leaves usually 2, 1-2" wide, 6-8' long, falcate, bracts 2, very broadly ovate, simply acute, 6" long; pedicels 6" long, stout, flattened like the peduncles, enlarged at tip, about 20; flowers densely clustered, large; sepals elliptical-lanceolate, rarely narrower, 4" long, 1½-2" wide, not spreading, thin and hyaline but with stout midrib, acute, ⅓ longer than the dark-purple stamens; filaments filiform except at very base; capsule with 3 central and 2-lobed crests; bulbs 1' long and ½' wide, elliptical-ovate; coats many, very thin, the outer layer of each only reticulated with fine, nearly square (rarely oblong) meshes which are vertical when not square; ribs about 18. Grows singly on gravelly slopes in Spring Valley, eastern Nevada, at 6,000-6,500' alt., in flower June 3, 1895; also Dutch Mt., western Utah, June 12, 1891, and Spring creek, western Utah, June 23, 1891. This includes all forms mentioned under A. Tolmiei from Utah and Nevada on page 11.

From material which has come to hand since the foregoing was in print it is evident that the A. scaposum group should come next to the A. cernuum group, and that to it should be added A. lacounsum which has walls of meshes straight and meshes erect and linear to oblong, like this group, the species is not at all related to A. bisceptrum (where Watson placed it).

A better arrangement than the one given would be to place A. Parryi, atrorubens, fimbriatum, decipiens, and probably cris-

tatum just before A. ambiguum so that A. Nevii and tribracteatum could come next to A. Brandegei to which species they are most related. The transverse markings of this whole group from anceps to tribracteatum are very much alike, being from narrowly oblong to linear, straight and acuminate at both ends, the sides uniform and without waves, meshes under a magnification of 40 diameters 3-4'' long and not over 1'' wide.

On page 11 A. campanulatum and A. Bidwelliæ are mentioned because they were originally described without bulbs. The former is almost certainly correctly placed on page 26 as a too close congener of A. bisceptrum into which it seems to pass at lower elevations in Nevada. A. Bidwelliæ is still an enigma unless it is a form of A. hyalinum as some suppose. A. scilloides and A. collinum are also mentioned on page 14 as unknown quantities though the place of the latter is probably on page 23.

A. Bolanderi should come after A. peninsulare. To the key in this group the last line should be "narrowly oblong" to linear "in general outline." On page 17 under A3B2C2D change "to" to "and" in second line, and omit "probably" in the next line.

On this same page A. macrum should be put where A. Nevii is and the latter should be placed under it as a synonym, as they are clearly identical, this has been determined from authentic material recently received. The last word under Nevii should be "macrum" and not "madidum."

On page 4, second line from the bottom, insert "into equal parts" after "branch."

A. Nevadense Watson. This little known species, when fresh, is characterized as follows: Leaf round, channeled on the upper side; bracts reddish-green; pedicels stout, 6'' long, ascending; flowers white: sepals with the outer 3 reddish-brown to the base, the inner 3 only at tip and a trifle narrower, not keeled, spreading at an angle of 45°, equal, 3'' long, oblong-ovate, acute but not acuminate, midrib greenish within; stamens 2'' long: filaments subulate: anthers oval-oblong, $\frac{1}{3}$'' long: style $1\frac{1}{2}$'' long:

ovary 1" high, truncate, 3-lobed to the middle, the groove being occupied by the filament, each cell with a thick wing from the outer edge to the style, the wing gradually elevated and lengthened up to the style where it is 2-3-lobed; bulbs ovate, with unate bulblets which usually are so close to the bulb that they seem to have no runner connecting, but sometimes the runner is 1' long, bulblets arise from the lower corner of the bulb.

A. bisceptrum Watson. A specimen of what seems to be this species gathered at Cove Creek, Utah, June 27, 1901, had the sepals and stamens grown to the very tip of the truncate and spongy ovary; crests triangular, toothed, purple, flat, fully half as high as the ovary.

The Utah usual forms of A. bisceptrum are better separated under the name of Var. **Utahense** n. var. with the character of plants robust, very succulent; leaves 3-4" wide; flowers white or only pink, lax; markings of bulb coats with thinner walls and broader meshes.

Authentic material of A unifolium received after the Note on page 30 was printed shows that the species is nearest related to A. attenuifolium and not to A. bisceptrum.

The reticulatum group (2A.) is manifestly badly confused, but the writer cannot separate the species, if there be more than three in the group, without more material.

For Key to the Onions by markings see last page, preceeding the illustrations.

NYCTAGINACEÆ. *

Corolla wanting, its place being taken by the corolla-like calyx, which opens in the late afternoon or evening and closes in the morning, and is campanulate to tubular and, except in Mirabilis multiflora and Hermidium, is very thin, delicate and soon wilting but persistent, its base thickened around the single seed, when the involucre is one-flowered it presents all the appearance of a calyx; stamens often united at base, 1-7, normally 5, filaments attached to the calyx, slender and with rounded anthers; style and stigma simple; ovary 1-celled and 1-seeded; flowers normally pink, rarely purple, white or yellow, usually collected in heads or clusters and always surrounded by separate or united bracts (bracts entirely absent in Bœrhavia spicata var. Palmeri), but they are readily distinguishable from a true calyx, except rarely in Allionia, by there being more than one flower in the cup formed by the bracts; fruit often grooved, ribbed or winged, enclosing the free akene, which has a membranous coat; embryo coiled around the mealy albumen and, in Abronia only, apparently of a single leaf; weak herbs with brittle stems and swollen joints; leaves mostly opposite and oblique, normally fleshy when fresh and rarely membranous when dry, petioled, without stipules, entire or only wavy on the margins, except Bœrhavia annulata, and often pubescent or glutinous. Probably all species are vespertine. This is a family of 20 genera and

* The following study of the Nyctaginaceæ is confined chiefly to the region of the Great Plateau, though a few Mexican and central Texas species are mentioned.

about 125 species, chiefly confined to tropical America; in our region there are a few species found as high as the Lower Temperate or Juniper Zone and are found only in arid places, exposed to the direct rays of the sun, and blooming till the close of the season.

SYNOPSIS OF GENERA.

A. Flowers not collected into a head, except some species of Bœrhavia; involucre not evident, the bracts, if present, being separate, small and situated on the pedicel, or apparently at its base.

1. SELINOCARPUS. Fruit with 3-5 prominent, thin wings.

2. BŒRHAVIA. Fruit 3- 10-ribbed, the ribs enlarged upwards, except in B. annulata and purpurascens, toward the summit. Plants blooming throughout the season.

3. ACLEISANTHES. Fruit 5- 15-ribbed, truncate at both ends, ribs usually not enlarged above; calyx tube filiform, not angled, 1 or more inches long; flowers mostly single, nearly sessile; stamens 2-5; leaves acute at base and short-petioled in ours.

2A. Flowers in heads.

2AB. Flowers surrounded by numerous and distinct bracts, leaves thick and leathery.

4. ABRONIA. Bracts all in a whorl at the base of the flower cluster, thin; flowers salver-form; stamens included; fruit conspicuously lobed or winged, at least at tip.

5. HERMIDIUM. Bracts leaf-like, not at the base of the flower cluster but each attached to the pedicel of a flower, and all densely aggregated, very large, green or colored and leathery; flowers funnel-form: bell-shaped; fruit globular and smooth, not lobed nor winged: perennials.

2A2B. Bracts united into a cup, at least at very base.

2A2BC. Fruit not winged nor tubercled on the angles; involucre 3-5-lobed; tufted perennials.

6. MIRABILIS. Involucre neither membranous nor enlarged in fruit.

7. ALLIONIA. Involucre conspicuously enlarged and membranous in fruit; stamens long-exserted.

2A2B2C. Fruit conspicuously winged and wings deeply cut and folded over one side toward each other, inclosing the two raised ribs which have stalked and pellucid globules scattered along them, outside of fruit without prominent ***ribs and sparsely tessellately rugose.***

8. WEDELIA. Involucre 3-lobed.

1. SELINOCARPUS Gray.

Delicate, slender-stemmed perennials, with small fruit and flowers; growing in the Larrea Zone of southern New Mexico, Arizona and Texas. One species in Nevada.

A. Plants rather viscid, rarely puberulent only; stamens 5.

1. **S. diffusus** Gray Am. Jour. Sci. 2 15 262. Stems widely spreading; leaves ovate to ovate-oblong; flowers nearly sessile; mostly in pairs; calyx tube 1½" long. Overton, Nevada, and also in Texas, etc.

2. **S. angustifolius** Gray Mex. Bound. 170. Stems not depressed, 6-8' high; leaves narrowly elliptical, nearly sessile; flowers solitary and at length nodding; calyx tube 1-2" long, funnelform; stamens exserted; seeds with 5 wings which are as wide as the fruit and enlarged at base where they form ribs; intermediate ribs 5. This seems to be the same as **S. lanceolatus** Wooton Torr. Bull. 25 304.

2A. Plants not viscid; stamens 2.

3. **S. chenopodioides** Gray Am. Jour. Sci. 2 15 318. Plants grayish, erect to widely spreading, leafy up to the cymes; leaves triangular ovate, acute, margins mostly wavy; flowers cymosely clustered and subumbellate, cup-shaped, with scarcely any tube; pedicels short. Arizona and New Mexico.

2. BŒRHAVIA L.

Involucre of 1-3 very small bractlets to each flower, absent in B. spicata var. Palmeri; stamens 1-3, stigma shield-shaped; fruit jointed to the pedicel and larger above, pyriform in B.

annulata and obliquely clavate and narrowed at the tip in B. gibbosa; slender and widely spreading herbs with small flowers; plants all of the Larrea Zone. The species of this genus are merely tentative as the characters are too variable.

1. Flowers small, interruptedly spicate and sessile; annuals with viscid stems (at least above), rather stout; strict peduncles paniculate; leaves undulate on the margins' slender petioled; fruit oblong-obovate, rounded, about 4-angled, smooth.

1. **B. Wrightii** Gray Am. Jour. Sci. 2 15 322. Leaves small, oblong-obovate to lanceolate, undulate, black dotted, white below; bractlets minute, purplish, fimbriate-ciliate, deciduous, 3 to each flower; flowers white; stamens 2; fruit 1-2'' long, roughened, acutely 4-angled and wrinkled; erect plants. Arizona and Texas.

2. **B. bracteosa** Wats. Proc. A. A. 20 370. Glandular hirsute throughout, except the leaves; leaves ovate to lanceolate, rounded at base; bractlets conspicuous, pink, acuminate into a thread-like tip nearly as long as the flower, persistent after the flower has fallen. Arizona and Texas. Said to be the same as B. Wrightii, but appears different.

2A. Flowers racemose.

3. **B. gibbosa** Pavon, Gray Am. Jour. Sci. 2 15 323, B. gypsophiloides (M. & G.) Coult. Fl. Tex. 354. A shrubby-based perennial with gray stems: leaves mostly lanceolate to linear, sometimes ovate, acute, 1-2' long; flowers very conspicuous, red, in long racemes; stamens long-exserted; fruit gibbous and clavate, reflexed, many ribbed, about 4'' long. Arizona to Texas.

4. **B. Coulteri** Wats. (Hook.) Proc. A. A. 24 70. Glutinous only in the middle of the internodes; racemes, in fruit, about 1' long and panicled; stamens 3, included; flowers 1'' long; bracts very small, single; fruit clavate, about 1½'' long, truncate, angles acute, channels reach the apex and are rugulose on the side;

leaves elliptical to oblong-lanceolate; delicate annual. Albuquerque, New Mexico, and southward. In my specimens the fruit is rounded at the apex.

5. **B. spicata** Choisy DC. Prod. 13 456. Flowers with conspicuous brown nerves and ½'' long; bracts ovate or ovate-lanceolate, acute, dark-colored; fruit with a pair of narrow bractlets at the base. Arizona.

6. Var. **Palmeri** Wats. Proc. A. A. 24 70. Finely pubescent; leaves nearly glabrous; flowering racemes 1-2' long; floral bracts none; stamens 2, included; flowers ½'' long; fruit clavate-oblong, 1'' long, obtuse, mostly obtusely angled, grooves very long and sinuate. Arizona.

7. Var. **Torreyana** Wats. Proc. A. A. 24 70, has thickish, scabrous, glandular leaves, and flowers about 1'' long. This abounds in New Mexico, Texas and Arizona.

B. Xanti Wats. Proc. A. A. 24 71. This has large, white flowers in a loose raceme about 1' long; stamens 4, long-exserted; fruit oblong-obovate, obtuse, 1'' long. acutely angled, rugose in the intervals. This occurs at Guaymas, Mexico.

3A. Flowers panicled, single, when young often in twos in B. anisophylla.

3AB. Leaves linear, or nearly so, thick, mucronate-acute, margins revolute; flowers rotate; bractlets 3-5; fruit 5-ribbed, glabrous, oblong-clavate, 2'' long, obtuse; diffuse plants, viscid at least above; petioles very short or none.

8. **B. linearifolia** Gray Am. Jour. Sci. 2 15 321. Flowers short pediceled, in an open cyme, purple, ½' wide: stamens 5. Texas.

9. **B. tenuifolia** Gray Coult. Fl. Tex. 355. Flowers few, loose, about 4'' broad, pubescent. wheel-shaped; stamens 3. Texas.

3A2B. Leaves not linear.

10 **B. anisophylla** Gray Mex. Bound. 181. Stems not hairy:

leaves ovate to irregularly oval, heart-shaped to truncate at base; flowers loosely cymose, short pedicelled, purple, 5'' wide; stamens 5-8, much exserted; fruit obovate-oblong, smooth, rounded, narrow-ribbed; bractlets 3. Western Texas.

11. Var. **paniculata** C. & F. Bot. Gaz. 17 348. Fl. Tex. 356. Panicle more diffuse; flowers minutely pubescent on the ribs; fruit purplish, pubescent, rugose between the ribs, tall plants. Western Texas.

4A. Flowers panicled and more or less clustered at the ends, few in the clusters.

4AB. Fruit ten-ribbed, except perhaps the first.

12. **B. decumbens** Vahl. Enum. 1 284. Glabrous, clusters arranged in an enlongated, spreading panicle with filiform peduncles; fruit obconic, scarcely grooved, rounded at apex; flowers angular with glandular ribs. New Mexico and southward.

13. **B. erioselena** Gray Am. Jour. Sci. 2 15 322. Annual; glutinous above, erect; leaves fleshy, glabrous, very wide, denticulate; flowers very hairy, cymose-panicled; fruit truncate. Western Texas.

14. **B. leioselena** Gray Mex. Bound. 172. Perennial, glabrous above, erect; leaves wide, glandular tubercled on both sides; panicles few-flowered toward the summit; flowers spooth. Western Texas.

15. **B. scandens** L. Sp. Pl. 3. B. Grahami Gray. Glabrous perennials climbing over weeds and brush; leaves heart-shaped to ovate, acute, short-petioled; flowers in umbels, 6-8, 2-4'' long, greenish, the clusters more or less panicled; stamens exserted; pedicels 2-6'' long; fruit linear-obovate, obscurely 10-ribbed, glabrous except at the black-glandular tip. Grows in ravines and valleys of eastern New Mexico and southward.

4A2B. Fruit five-ribbed or angled.

4A2BC. Annuals.

16. **B. purpurascens** Gray Am. Jour. Sci. 2 15 321. At least the branches very glandular; lower leaves oval to oblong, obtuse, glabrous; upper linear-lanceolate, peduncled; panicles with five to eight-flowered clusters; bracts purple and very viscid, enveloping the fruit, tardily deciduous; calyx purplish, bell-shaped, 1½" long, equaling the fruit; stamens 3; fruit obovate, glabrous, ribs prominent, narrow. Arizona and Texas.

17. **B. erecta** L. Sp. Pl. 3. Leaves generally minutely black-dotted, broadly ovate, obtuse, margin sinuous, paler beneath; panicle very open; bracts minute; mature clusters 2-5 flowered; stamens 2; fruit scarcely pediceled; about 2" long, smooth, truncate, rugulose between the ribs. Western Texas to Florida and West Indias.

4A2B2C. Perennials.

18. **B. ramulosa** n. sp. Tall perennial, very widely spreading and above diffusely cymose-panicled, the filiform peduncles 1-2' long and branching at the top into 3-4 very short (1-4" long), subumbellate rays which have 3-5 flowers on the ends on very minute but evident pedicels; leaves nearly oval to ovate, the lower about 1' long, acute to obtuse, the lower cordate and the upper cuneate at base, gradually reduced to minute and subulate bracts above, leathery, smooth, whiter below, petioles slender, 6-12" long; whole plant minutely pubescent throughout, also glandular above; flowers small; fruit oblong-obovate, rounded at tip and tapering at base, about 1" long, 5-ribbed, the broad interspaces plane, hispid-glandular throughout. No. 4194 Jones, El Paso, Texas, Sept. 11, 1884. See Fig.

19. **B. hirsuta** Willd. Phyt. 1. Hirsute and glandular, as to stems and petioles at least; leaves ovate, acutish, rounded at base, margins undulate; petioles short; panicle loose and divaricate; flowers nearly sessile, in small clusters, at the ends of slender peduncles; bractlets minute; calyx red, 1" long; stamens 3; fruit 1-2" long, clavate, obtuse, glandular. Western Texas.

20. **B. obtusifolia** Lam. Ill. 1 10. (B. viscosa, Lag.) Mi-

nutely pubescent or viscid, stems straight; leaves ovate-oblong to ovate-lanceolate, mucronate, acute at base, smooth, white beneath, slender petioled; peduncles solitary, two-cleft, mostly shorter than the leaves; flowers minute; stamens 3; fruit clavate, acutish, with glandular ribs. Western Texas.

4A3B. Fruit 3-5-winged or almost ribbed in the first, obpyramidal, truncate; probably all annuals.

21. **B. intermedia** n.sp. Slender annual; not at all glandular, slightly pubescent below; leaves elliptical to oblong lanceolate, obtuse, apiculate, whiter below, slender petioled, rounded at base, about 1' long, sinuate on the margins, not black-dotted; branches panicled, with a single filiform peduncle in most lower axils about 6-12" long, but above dichotomously cymose-panicled, the ultimate peduncles 4-6" long, peduncles bearing 2-5 umbellate, campanulate flowers about 1" long, which equal the ovaries; stamens included; fruit not contracted to a stipe, on a filiform pedicel, about $\frac{1}{2}$" long, ribs raised into pseudo wings, narrower than the body, rugulose between the angles. El Paso, Texas. Distributed as B. erecta, No. 4173, Jones. SEE FIG.

22. **B. triquetra** Wats. Proc. A. A. 24 71. Low, puberulent and viscid; leaves lanceolate, pedicels very short; flowers pink, 1" long; stamens 2, included; fruit 1" long, very acutely 3-4 angled, sides rugose, not contracted into a stipe. Gulf of California.

23. **B. alata** Wats. Proc. A. A. 24 69. Puberulent, reddish; leaves narrowly oblong to linear, or lower ones broader; flowers loosely panicled, solitary, clustered on slender pedicels, 1-3" long; stamens 5, included; fruit nearly 2" long, rather broadly 5-winged, the wings often broader than the body. Guaymas, Mexico.

24. **B. pterocarpa** Wats. Proc. A. A. 17 376. Nearly smooth, prostrate or widely spreading and low annual; leaves ovate, acute, short petioled, less than 1' long, with undulate margins, white below; stems pubescent; flower clusters in pani-

cled, leafy racemes, each cluster nearly sessile in the axil of the leaf; flower minute, sessile, but base contracted into a stipe; fruit prominently 3-4-winged at the apex and wrinkled between the ribs. Arizona.

5A. Flowers panicled, many, in umbels at the end of peduncles.

25. **B. annulata** Cov. Death Valley Rep. 177. Tall perennial, stems rather stout with glutinous spot on each internode; leaves ovate to oblong-ovate, glandular dotted and hirsute, irregularly toothed or lacerate, 2-3' long, cordate at base and with the flowers and fruit loosely villous; bracts of the inflorescence minute; flowers in clusters at the ends of the branches, small, with three conspicuously exserted stamens; fruit about 2" long, narrowly oblong-pyriform, barely angled by ribs, narrowed at both ends, sometimes smooth. This grows in the Death Valley region, California.

3. ACLEISANTHES Gray.

Plants of the Larrea Zone of Arizona to Texas and New Mexico.

A. Plants glabrous or nearly so, prostrate to trailing; flowers 2-6' long.

1. **A. anisophylla** Gray Am. Jour. Sci. 2 14 319. Plants prostrate; leaves oval to ovate, very unequally paired; flower 1½-2' long, much longer than the width; fruit 2" long, 10-ribbed. Western Texas.

2. **A. longiflora** Gray Am. Jour. Sci. 2 15 319. Trailing and glabrous plants; leaves deltoid-ovate to rhombic-lanceolate; flowers white and fragrant; calyx tube 4-5' long; fruit cylindrical, 5-angled and 10-ribbed, ribs not enlarged above. El Paso, Texas.

2A. Plants rough-pubescent; flowers about 2' long.

3. **A. Wrightii** (Gray) B. & H. Am. Jour. Sci. 2 14 318. (Pentachrophys Gray.) Plants scabrous and widely spreading:

leaves oblong, about 1' long; calyx tube 1-2' long; fruit 3-4'' long, 5-ribbed and ribs glandular an usually thickened above. El Paso, Texas and southeastward.

4. **A. crassifolia** Gray Am. Jour. Sci. 2 14 319. Plants scabrous-puberulent, decumbent; leaves thick, rounded at base, ovate; flowers 6'' wide; fruit ovate, scarcely ribbed. Western Texas.

5. **A. nummularia** n.sp. Like A. crassifolia but leaves oval, 1½-2' long, coarsely pinnate-ribbed, glaucous below, erose, black-dotted, clustered at base; flowers paniculate and panicle smooth; plants apparently erect. El Paso, Texas. Sept. 12, 1884. Jones.

4. ABRONIA Jussieu.

All caulescent plants except the scapose A. nana; flowers often very fragrant, many, in a dense head; wings of fruit net-veined, sometimes rudimentary in A. umbellata and absent in A. alpina; seeds smooth and cylindrical; at least the flowers generally viscid; bracts of the involucre wrapped over the flowers in the bud; seeds chestnut colored.

A. Ovary lobed by the cavity extending into the wings thereby making the base of wings double; wings wider above, extending below the base of the seed only in A. cycloptera and A. micrantha; seeds acutish, flattish, 1½'' long, nearly oblong, barely half filling the cavity in its length.

AB. Widely spreading or cæspitose perennials, with stout stems when present; flowers fragrant, except in A. nana, not red; wings tapering from the apex to nothing at the base of seed.

1. **A. nana** Wats. Proc. A. A. 14 294. Shortly-pubescent; cæspitose and acaulescent plants; leaves elliptical and acute at both ends, sometimes with obtuse tip and truncate base, on very long petioles: peduncles scapose from a rather woody stem which

is so condensed that the dead petioles are closely imbricated; bracts large, oval, scarious, white, rounded; fruit with 5, hollow, wide, thin wings which are wide at tip and soft and papery, making the fruit without a leathery body; seed like that of A. villosa but very flat and oblong-lanceolate. This grows in the Juniper Zone of the Great Basin and northern Arizona. Not common.

2. **A. fragrans** Nutt. Kew Jour. Bot. 5 261. A. elliptica E. Nels. Torr. Bull. 26 7. Nearly prostrate with rather sparse leaves which are from oval to oblong-ovate, the blade being 1-2' long and as long as the lower petioles but much longer than the upper ones; bracts like those of A. nana, few, normally large, white, rounded, papery, and often 1' long; flowers white or only tinged; fruit without thickened disks at the top of the wings (rarely a wing or two has a slight thickening at top). This grows in the Juniper Zone from Nevada and Oregon eastward to Iowa and southward to Texas, Arizona and Mexico. Common.

3. **A. latifolia** Esch. Mem. Ac. Pet. 10 281. A. arenaria Menzies. This maritime species of the northern Pacific coast is prostrate and very viscid, with five small bracts and yellow flowers.

A2B. Annuals; stems slender and widely spreading.

4. **A. turbinata** Torr. King's Rep. 5 285. Leaves from nearly reniform to ovate, acute, base mostly triangular; flowers greenish-white to rose-colored; fruit not very rigid, mostly with disks on the upper end of the wings. A. Suksdorfii C. & F. Bot. Gaz. 17 348 is the same but without the disks. This grows in the Juniper Zone of western Nevada and eastern California to Oregon. Common.

5. Var. **Carletoni** (C. & F. Bot. Gaz. 17 349.) A. angustifolia Greene Pitt. 3 344. Leaves from oblong-ovate to oblong-linear, mostly acute; bracts subulate-lanceolate; wings of the turbinate fruit variously pubescent and with or without disks; flowers mostly greenish-white. This intergrades with the type

at all points. From eastern Colorado southward to eastern Arizona. Common.

2A. Ovary not lobed; wings consisting of a single blade, absent in A. alpina.

2AB. Wings wider above than below (narrowed above also in A. umbellata var. alba), generally reduced to a vestige at the base of fruit, never produced below it; seeds like those of section A.

2ABC. Perennials, prostrate.

6. **A. mellifera** Dougl. Bot. Mag. t 2879. Very widely spreading and slender, in tufts, often four feet in diameter; flowers white; bracts of the involucre scarious, 3-6'' long; fruit wings often much elongated laterally and wider than the fruit; leaves ovate to oblong-lanceolate, truncate to cuneate at base, on slender petioles; seed nearly linear, otherwise as in A. villosa. Grows in the Juniper Zone of southern Oregon and western Nevada.

7. **A. umbellata** Lam. Ill. t 5. Involucral bracts narrowly lanceolate, not over 3'' long; flowers rose-colored; wings as in the above, inner coat that of A. gracilis; seed the same. Common along the Southern Pacific sea-coast only.

8. Var. **alba** (Eastwood Proc. Cal. Acad. 3 1 97.) Closely resembles the above but has the wings widest in the middle or a little below the middle and rudimentary at tip and base. Southern Pacific sea-coast.

9. **A. alpina** Brandegei Bot. Gaz. 27 456. Forming mats 15' in diameter, viscid-pubescent; leaves nearly orbicular, $1\frac{1}{2}$-$2\frac{1}{2}$'' wide, petioles 5-$7\frac{1}{2}$'' long; peduncles $2\frac{1}{2}$-3'' long; bracts 4-5, narrowly ovate-acuminate, 1-$1\frac{1}{2}$'' long; flowers 5, rose-colored to white, 6-$7\frac{1}{2}$'' long, 4-5'' wide; fruit $1\frac{1}{2}$-2'' long, narrowed at both ends, thin-coriaceous, obtusely to acutely 5-angled, glabrous, tuberculate veined, not winged. Probably is a depauperate form of A. umbellata. Monatchy meadows, Mt. Whitney, Cal.,

7-8000° alt.; at Templeton in loose granite sand. Purpus, Nos. 1877, 1497.

10. **A. maritima** Nutt. Bot. Cal. 2 4. Very stout; involucral bracts short, ovate-oblong; flowers red; wings of fruit somewhat leathery; otherwise as A. umbellata. Southern Pacific sea-coast.

2AB2C. Slender and widely spreading annuals.

11. **A. gracilis** Benth. Bot. Sulph. 44. All but the lowest leaves very villous-glutinous. leaves rhomboidal to ovate, obtuse, wavy, about 1' long or less, with variable petioles; flowers bright-pink, about 4-5'' wide; fruit much like that of A. villosa but wings not so produced. inner coat with peculiar markings; seed flat and oblong-ovate. Tropical Zone of southern California and southward.

12. **A. villosa** Wats. Am. Nat. 7 302. Involucral bracts lanceolate and acuminate, not over 4'' long; flowers pink; fruit with a firm body, strongly net-pitted; 3-5 thin wings without disks, truncate to acute above; seed shiny, lanceolate; leaves oblong to ovate, wavy, obtuse, base triangular; villous plants. Grows in the Larrea Zone of southern Nevada and Utah.

13. **A. angulata** Jones Cont. 8 39. Whole plant very glandular hairy, even to the flowers, except the leaf blades; stems angled; bracts white, oval to broadly ovate, acutish, 3-4'' long; fruit 2'' long, body oblanceolate, $\frac{3}{4}$'' wide, wings but little contracted below fully 1'' wide at the produced apex, fruit in outline seems obcordate. Southwestern Nevada and eastern California.

2A2B. Wings very wide all around and produced above and below the seed; rather short and stout-stemmed annuals, widely spreading; leaves ovate or narrower; petioles equaling the leaves and 1-3' long; bracts small, not over 4'' long; body of fruit stipitate and pistil prolonged at the apex to the edge of the wings; wings reticulated around the margin and transparent; body of the fruit 1-3-ribbed on each side; flowers about 1' long, greenish to red; seed linear,

cylindric, about 3'' long, filling the entire cavity; whole plant smooth, or rarely glutinous, short-hairy above.

2A2BC. Stipe of fruit short; wing rounded to emarginate at apex and with a double network, the primary meshes being filled with many fine and much-branched lines; peduncles scarcely exceeding the leaves, often short.

14. **A. micrantha** (Torr. Frem. Rep. 96) Choisy DC. Prod. 13 2 436. Has the fine double network throughout the wing, and ribs not conspicuously raised nor winged, nearly straight; wings rounded or rarely emarginate at tip; flowers in the type small and greenish and peduncle shorter than the petiole. Grows in the Navajo Basin, also on the plains of southern Wyoming and Colorado; Juniper Zone. It is difficult to separate this from A. cycloptera.

15. Var. **pedunculata** Jones Cont. 7 716. Flowers often large and pinkish, peduncle longer than the leaves or as long; bracts broader. Navajo Basin of eastern Utah.

16. **A. Crux-Maltae** Kell. Proc. Cal. Acad. 2 71. This has the fine double network around the edge of wing only, outline of wings oblate, emarginate; ribs raised into very stout transverse wings or rays at the base, making the body of the fruit look like the burrs of Xanthium spinosum or Cenchrus. These rays extend even to the meshes of the wings; flowers large, red, very fragrant; bracts acute; leaves elliptical-oblong, mostly acute; peduncles slender; found only in the Juniper Zone of western Nevada and Oregon.

2A2B2C. Wings without a double network throughout, not emarginate nor rounded at the apex, often acute; stipe of fruit long, peduncles elongated.

17. **A. cycloptera** Gray Am. Jour. Sci. 2 15 319. Flowers large, red; main ribs of wing bent at least at base, not raised into transverse flat rays, but arising from spongy bases. Grows in the Juniper Zone of eastern Colorado, New Mexico, Green

river, Utah, and southward. A. carnea Greene Pitt. 3 343 is a robust form.

The only other species of Abronia, A. pogonantha Heimerl, Engl. Bot. Jahr. 11 87 t 2, that exists in our region, is not known to the writer, but is described as follows: Like A. turbinata but bracts 5, ovate, a little larger, very shortly acuminate; base of the outer flowers often 2-winged, of the inner flowers obovate-obconic, lobes obcordate, rose colored; stamens often 6; exterior fruits irregularly orbicular, very often 2-winged, delicately reticulate-nerved, the inner fruits wingless and obovate and similarly nerved. The irregular development of wings is hardly a good specific character. This may be a form of A. angulata. Mojave Desert, Calif., Parish 1882, No. 1345.

5. HERMIDIUM Wats.

Stamens 5-7; flowers clustered on upper part of stem, rarely a single cluster lower down, about 1' long; leaves large; genus of a single species, confined to the Juniper Zone of the Great Basin from the Sierras to western Utah.

1. **H. alipes** Wats. Bot. King 5 296 t 32. A stout and very leathery plant, perfectly smooth, nearly erect; leaves on very short and thick petioles; heads about 6-flowered on short peduncles; bracts ovate, heart-shaped, about 9'' long, and acute; flowers as long, slightly lobed, purple, as long as the stamens and style. This plant very closely resembles Mirabilis multiflora and differs from it but little, except in the bracts.

6. MIRABILIS L.

Stamens usually 5, at least as long as the calyx, stigma capitate; flowers rose-colored to purple, rarely white.

A. Coarse plants with large flowers.

AB. Flowers with long and narrow tubes, clustered.

1. **M. Jalapa** L. The common four o'clock is a smooth plant, with many-colored and short-stalked flowers; calyx tube

thick; stamens not longer than the calyx. Probably escaped from cultivation in the Tropical Zone of Arizona.

2. **M. Wrightiana** Gray Trans. N. Y. Acad. 14 28, generally referred to M. longiflora L. Viscid pubescent at least above; blade of leaves halberd-shaped, with an acuminate tip, 2-3' long, prominently veined, lower petioles about as long as the blade; stems nodose, paniculately branched, tall and nearly erect; flowers sessile in the involucre; lobes of the involucre subulate from a broad base; calyx tube about 2-3' long; stamens and style much exserted. Southern Arizona to Texas and southward.

A2B. Flowers with a short and broad tube, barely as long as the involucre, about 1-2' long, mostly purple.

3. **M. multiflora** (Torr.) Gray Am. Lyc. N.Y. 2 237. Mex. Bound 169, Stout and coarse with large leaves on short petioles; flowering peduncles short; involucre large, not deeply cleft, five lobed, with acute lobes; flowers usually six within the involucre, 1½-2' long, large, not delicate, the lobes nearly rotate, spreading, purple or purple-streaked, concave, base star-like by stiffer and triangular ribs which run to the sinuses and project as teeth, throat with a dark wine-purple ring, tube long-conical, ribs feather-veined; stamens and style declined below and upcurved at tip; style longer than the involucre; fruit nearely ⅓' long, marked toward the base with ten oblique furrows, smooth. Tufted and decumbent plants. This occurs in the Juniper Zone, sparingly, from Colorado to California and southward to central Arizona.

Var. **Froebelii** (Behr) Proc. Cal. Acad. 1 69. var. pubescens Wats. Bot. Cal. 2 2. Plants very pubescent throughout. This hardly deserves varietal rank. A form of it with upper part of plant very pubescent occurs in eastern Nevada, in the Juniper Zone. Variations also occur in Utah with the outside of calyx and upper part of plant short-pubescent and glutinous with minute hairs standing straight out from the plant.

2A. Straggling and slender plants with small leaves and flowers, the latter with tube very short.

4. **M. Californica** Gray Mex. Bound. 173. **M. lævis** (Benth.) Curran, Bot. Sulph. 44, Proc. Cal. Acad. 2 1 235. Flowers 1-3, less than 6‴ long, broadly funnel-form with a short tube, very delicate; involucre bell-shaped, not over 3″ long, five-cleft with acute lobes, fruit broadly obovate, 1½-2½″ long, obscurely 10-grooved; leaves broadly ovate, 1′ or less long, on very short petioles. This belongs to the Larrea Zone from southern Utah, California and southward and runs up into the lower Juniper in the Sierras. M. Bigelovii Gray Proc. A. A. 21 413 with very viscid-villous pubescence, stems and rounded leaves flaccid, flowers pale and little longer than the involucre, is probably only a form of this; it is found at Peach Springs, northern Arizona.

5. **M. tenuiloba** Wats. Proc. A. A. 17 375. Viscid-pubescent; like M. Californica but leaves somewhat acuminate, with cordate base, and often halberd-shaped; involucre 3-5″ long, cleft below the middle and divisions narrowly lanceolate; petioles slender, 6-9″ long; stems white; seeds oblong, barely grooved, a trifle wider above, ⅓″ wide, 1½″ long. Probably only a form of this very variable species, but leaves remarkable. San Bernardino Co., Cal., to Fairview near Williams, Arizona. Juniper to Larrea Zone.

7. **ALLIONIA** Lœfl. (Oxybaphus Vahl.)

Stamens usually 3; fruit several-ribbed or angled except in A. oxybaphoides; involucres 5-lobed and 1-5 flowered, in fruit generally spreading out flat, especially after the fruit has fallen, flowers bell-shaped, very delicate, translucent, with delicate ribs, white to purplish (except A. coccineus, which has conspicuous, red, nearly tubular, long flowers), small; stigma capitate on a filiform style; plants tufted, tall and erect, often widely branched; A. hirsuta sometimes 1° and A. Bodini not

over 6' high; perennials with straight stems. The species of this genus are based on too variable characters to be of much value.

A. Stems glaucous, except in A. linearifolia; leaves linear, fruit pubescent.

1. **A. Bodini** (Holzinger Cont. Nat. Herb. 1 287 pl. 21.) Morong Mem. Torr. Club 5 355. Low plants, 2-5' high, not more than minutely pubescent; diffusely branched, slender branches divergent; leaves narrowly linear, sessile, ¼-1¼' long, 1" wide or less, slightly narrowed at both ends, fleshy; involucre single, short-pedunculate in upper axils, finely pubescent, about 3" wide when mature, 5-lobed about to middle, lobes ovate-oblong, acute; fruit narrowly obovoid, obtusely 5-ribbed, very pubescent, 2½" long. Juniper Zone or Lower Oak of eastern Colorado, also Pueblo. A. Bushii Britton Bull. Torr. Club 22 223 seems to be the same, with stalked involucres. This grows in Missouri.

2 **A. linearis** Pursh Fl. 728. Slender and glaucous plants, except the pubescent peduncles and involucres; stems striate, bushy and tufted, 2-3° high, branches many, coming out at an angle of 45 degrees; leaves filiform to broadly linear, leathery, generally elongated; fruit ribs 5-7, smooth, fruit scarcely tubercled; base of flower hemispherical to 1" above base, then rotate-campanulate, lobes oblong-ovate, 2" long, wavy or erose, obtuse; stamens arise from the center of the base of flower with capillary, scarcely tapering filaments 6-8" long, tips bent and twisted; anthers didymous, of 2 obliquely oblong parts which are yellow-warty as if glandular but are really glabrous, fixed by the middle, rather large, with few large pollen grains; pistil fully 1½ times the filaments, capillary, coiled at least in the bud, tip a rather large, flattish knob, style often purplish, rest of flower white, except the anthers; flowers erect, outside of calyx and involucre glandular. Grows from the upper Juniper Zone southward, Iowa to Idaho and Utah and southward. Oxybaphus angustifolia Sweet.

3. Var. **coccinea** (Torr.) Mex. Bound. 169, resembles A. angustifolia except that the flowers are long, nearly tubular and

red; flowers in ours tubular-bell-shaped. Arizona and New Mexico.

4. **A. linearifolia** (Wats. Proc. A. A. 17 376). Slender plants, 2° high, with spreading branches from the alternate axils, glabrous except the pubescent peduncles, involucres and flowers; leaves linear, narrowed at base, the lower 3-4' long; peduncles very slender, spreading or reflexed, 2-4' long; involucres 1-2-flowered, becoming 6'' wide, cleft to below the middle, the lobes acute to acuminate; flowers greenish, bell-shaped, 2-3'' long; stamens 5; fruit oblong-obovate, pubescent, very prominently 5-ribbed, the ribs thick and almost touching. Resembling some forms of A. nyctaginea. Valleys of southern Arizona in the Tropical Zone.

A. diffusa Heller Minn. Bot. Stud. 2 33. Upper part of plant glandular, plants diffuse; leaves lanceolate-linear, somewhat narrowed below; $2\frac{1}{2}$-4' long, all acute, grayish on margin; flowers clustered at the ends of branches; mature involucres $3\frac{1}{2}$'' wide, lobes triangular-lanceolate, acutish, 1-$1\frac{1}{2}$'' long; flowers 3'' long, lobes broadly obovate; stamens 3, exserted. This appears to be a 3-stamened form of A. linearifolia. Gravelly hills, Santa Fe, New Mexico.

2A. Neither with glaucous stems nor linear leaves.

2AB. Fruit smooth, involucres 1-5 flowered.

2ABC. Flowers solitary; plants of southern Utah and northern Arizona.

5. **A. glaber** (Wats.) Kuntze Am. Nat. 7 6. Smooth, panicles large and open; flowers solitary in the involucre, on slender pedicels 2-3'' long, shorter than the involucre; fruit oblong, strongly tuberculated between the prominent ribs. Southern Utah to Texas.

2AB2C. Flowers not solitary; plants of the Mexican Boundary region and Texas.

2AB2CD. Plants glabrous, except the peduncles in A. aggregata.

6. **A. corymbosa** (Cav.) Kuntze Var. Texensis Coult. Fl. Tex. 351. Leaves cordate-acuminate, margins sinuous; flowers terminal and crowded; involucre 2-3 flowered. On the Rio Grande, near El Paso, Texas.

7. **A. aggregata** (Vahl.) Spreng Ic. 5 437. Branches erect; leaves lanceolate, short-petioled, margins ciliate; peduncles solitary, axillary, villous, somewhat nodding. Prairies of western Texas.

2*AB2C2D. Plants pubescent.*

8. **A. oxybaphoides** (Gray) Kuntze Sill. Jour. 2 15 320. Stems slender, widely procumbent; leaves all deeply cordate, on rather long petioles, lowest leaves reniform, upper ones acuminate and sometimes angled; involucre 3-flowered, very glandular as well as the loosely panicled peduncles; fruit round-ovoid, without ribs. Mountains near El Paso, Texas, and southward.

2A2B. Fruit pubescent; involucre 3-5 flowered.

9. **A. albida** Walt. Fl. Car. 84. Stems erect, striate, 4-angled below, 1-3° high, glabrous to pubescent above; peduncles and branches variably glandular; leaves lanceolate to oblong-lanceolate, 3-nerved from base, the upper sessile and variably pubescent, lower short-petioled; involucres much enlarged in fruit, purple-veined; flowers pink; stamens often exserted; fruit 5-6-ribbed, obtuse, roughened in the grooves. Colorado to Texas and eastward.

10. **A. nyctaginea** (Mx. Fl. 1 100) Kuntze. Leaves nearly smooth, all petioled except the uppermost reduced ones, obtuse or heart-shaped at base; stems repeatedly forked. This occurs in the Lower Oak and Upper Juniper Zones from Wisconsin to the upper Missouri and southward to New Mexico and Texas and westward as far as the Rocky mountains of Colorado, but does not occur on the western side of the Rocky mountains, nor do its varieties.

Var. **Cervantesii** (Lag.) Choisy DC. Prod. 13. Branches and

involucre viscid pubescent or hairy and hairs jointed; leaves rather leathery and heart-shaped at base. Colorado and southward.

Var. **ovata** (Pursh Fl. 97) Morong Mem. Torr. Club 5 146. Leaves oblong to ovate-lanceolate, not heart-shaped. Colorado and southward.

Var. **latifolia** (Gray) Coult. Fl. Tex. 352. Involucres glabrous or glabrate; leaves ovate to cordate, submembranous. Texas and New Mexico to Wisconsin.

11. **A. hirsuta** Pursh Fl. 2 728. Fruit hairy, with 5 main ribs and as many intermediate ones which do not run to base of fruit, all tubercled; plants very densenly pubescent, with long, jointed hairs; leaves lanceolate, thick, upper ones sessile; the lower short-petioled. Eastern side of Rocky Mountains, Colorado and southward. Probably a form of A. nyctaginea.

NYCTAGINEA CAPITATA Choisy, a prostrate annual with many-bracted and many-flowered involucres, grows on the Staked Plains of Texas.

8. **WEDELIA** Lœfl. (Allionia L.)

Involucre not changed in fruit; flowers 3, funnel-form, not over $\frac{1}{2}$' long; stigma capitate; stamens 3-5, about as long as the flowers; slender and prostrate plants, probably perennial but blooming the first year.

1. **W. incarnata** (L.) Kuntze. Viscid pubescent, slender petioled; involucre cleft to or below the middle, small; flowers white to rose-colored, not over 4" long; anthers oblately orbicular, emarginate above and below; plants often woolly throughout. Grows only in the Larrea Zone from California to Colorado and southward, but is not found in the Great Basin.

MISCELLANEOUS SPECIES.

Peucedanum bicolor Wats. Coulter and Rose erroneously describe this species as to the leaves. The writer's specimens come from Watson's type locality. The leaves are ternate with tripinnate divisions, segments filiform, 1-3" long. They should also have put this in the section with P. ambiguum and not with P. caruifolium as it is more closely allied to the former.

Peucedanum bicolor var. **gumbonis** n. var. This has the same habit as the type, it grows in sticky clay soil on slopes where little else will grow, it has the same moniliform roots or string of tubers as the type, (not cæspitose as stated by Coulter and Rose) and is like it also in the following particulars: Stems 1-1½° high, one to few from the same crown, ascending, leafy, glabrous; petiole wholly dilated; rays few, very unequal, 1-4' long; involucres none; flowers yellow, many, small, dense, pediceled; fruit with a strong odor, 6" long, 1½" wide, truncate at both ends, linear-oblong, a little narrower at tip than base, scarcely at all narrowed below; lateral wings reduced to thick white corky lines, dorsal ribs are minute white lines; fruit arcuate a little, in dense heads. This variety differs from the type in having ternate and not bipinnate segments, the larger ones being 6-12" long, acute, linear, not over 1" wide; flowering pedicels almost none, fruiting pedicels not over 1" long, stout; oil tubes prominent, large, apparently only one in each interval, 2 on the commissure, dorsal ribs evident. Gathered on Monroe Creek, April 20, 1900, and in Indian Valley, southern Idaho, July 15, 1899.

Peucedanum Grayi var. **aberrans** n. var. Leaf segments filiform, oil tubes interrupted and variable in length except the central

one in each interval normally 2, rarely 1 or 3 in each interval. Monroe Creek, April 20, 1900, Middle Fork of the Weiser River, July 14, 1899, Cuddy Mts., July 11 1899, Snake River below Weiser, April 28, 1900, all in southern Idaho.

Leptotaenia multifida and L. Eatoni Coulter and Rose. These do not hold their characters, the dissection of the leaves, shape of the seed face, and corky nerve are not good as separating characters. The same oil tubes are present in the one as in the other but they are empty in L. multifida generally. The same tendency is shown in Cymopterus purpureus where, when the oil is very abundant, the tubes coalesce and make one large tube in each interval.

Leptotaenia filicina n. sp. Plant 3° high, glabrous; leaves with wholly inflated petioles, ternate, with segments pinnately decompound into filiform and very short lobes; rays 1-3' long, 10 or less; pedicels 3-6'' long; involucels of few, inconspicuous bractlets; fruit 6-8'' long, 2'' wide, with narrow and slightly thickened margins; oil tube 1 in the intervals and prominent, 2-4 on the commissure, irregular and small; seed face nearly flat, but seed arcuate. This has the leaves of Peucedanum Grayi, the fruit nearly that of P. bicolor but is flat and thin. It would seem to be a Peucedanum with aborted lateral wings, but is nearest to L. Salmoniflora C. & R. Gathered in the Seven Devils Mts., Idaho, Aug. 5, 1899, at 6000° alt.

Cymopterus terebinthinus var. **albiflorus** (Nutt.) Pteryxia albiflora Nutt. T. & G. Fl. 1 625. This often has but one dorsal wing developed, the rest being reduced to lines or nerves, and it shows the weakness of the custom of making such genera as Pseudocymopterus, etc., on the low development of dorsal wings. The flowers are yellow. This is a well marked variety because of the rigid and falcate divaricate leaf segments. Weiser, Idaho, July 6, 1899. An intermediate form is from the Cuddy Mts., Idaho, July 11, 1899.

Viola vallicola Nelson is only a form of V. præmorsa and

that species and V. Nuttallii cannot be separated, for the pubescent ovary does not hold.

Gilia sinister n. sp. Section Collomia and apparently allied to G. aristella. Annual, slender, erect, much branched above and branches repeatedly branched as if racemosely and, with the flowers, appearing racemose, but always opposite a bract, not in the forks except now and then a single flower on a plant is so situated, glutinous hairy except the glabrous leaves and the calyx which is glabrous at least after flowering; leaves linear-lanceolate, acuminate at both ends, barely petioled, the larger ones about 1' long, folded and so seeming to be obliquely linear, entire, 2'' wide, gradually passing into minute bracts at the top: flowers single on filiform pedicels, nearly erect, light-blue, 2'' long, funnel-form; pedicels normally 3-6'' long, but when bracteate in the middle by the abortion of a flower then often 1' long, rarely a pedicel is found 1' long without a bract; lobes ovate, streaked; throat dotted; proper tube 1'' long and equaling the calyx; stamens very unequally inserted; flowering calyx minute, narrow, acute at base, 1'' long, 5-striped, otherwise white and hyaline, 15-nerved in fruit, subulate lobes $\frac{1}{2}$'' long, not aristiform in flower but cuspidate in fruit; fruiting calyx narrowly oblong, enlarging with the capsule till it is broadly campanulate and $1\frac{1}{2}$' long, capsule as long as calyx and teeth, nearly oval, not narrowed nor stipitate at base, cells 2-seeded, seeds without spiricles. This has the general appearance of G. inconspicua but without the basal leaves. Middle Valley, southern Idaho, July 7, 1899, in gumbo soil.

Spiræa lucida Dougl. Greene in Pittonia 2 221 says of this, "stems ..... of annual growth from horizontal running and woody not deepseated rootstocks or roots, lower leaves small and obovate, the upper oval, 1 or 2 inches long, acutish, incisely serrate, flowers white." The stems are not from annual growth from horizontal rootstocks or roots but they arise the same as in small forms of Neillia, the lowest leaves are obovate to oval and nearly entire and obtuse, the upper leaves are larger, ovate-

oblong to broadly-elliptical, obtuse or acute, nearly doubly serrate above the middle and entire at base. The variety rosea is the same but leaves normally smaller and barely doubly serrate, often nearly entire. Old stems of both forms are dark-chestnut; calyx lobes not embracing the akenes. I have the type species from various places in the mountains of southern Idaho where it is common. The variety I have from Summit in the Sierras, California, from Payette Lake, Idaho, and from Reno, Nevada, in the mountains.

ASTRAGALUS.

The following are changes in nomenclature that seem necessary in the making of new combinations. Certain new species and varieties are added.

A. decumbens var. **convallarius** (Greene Erythea 1 207). A. campestris (Nutt.) Gray.

A. decumbens var. **serotinus** (Gray Pac. R. R. 12 18 51). A. serotinus Gr. l. c.

A. humistratus var. **Sonorae** (Gray Pl. Wright 2 44). A. Sonoræ Gr. l. c.

A. humistratus var. **Hosackiae** (Greene Bull. Cal. Acad. 1 157.) A. Hosackiæ Greene l. c. This hardly deserves varietal rank, though peculiar. It is a form growing in the shade.

A. flexuosus var. **elongatus** (Hook Fl. 1 140). A elongatus Hook l. c

A. bicristatus var. **tetrapteroides** n. var. Pods a little winged at the sutures; stipe twice the calyx; flowers in dense heads which scarcely elongate with age, large; calyx teeth barely $\frac{1}{3}$ the tube; peduncles only a little longer than the leaves. Bear Valley,

San Bernardino Mountains, California. Jones, August, 1900.

A. Pomonensis n. sp. Pods about 2' long, obliquely ovate, nearly round in cross section, densely congested into a swab 4-6' long, on a stout peduncle, membranous, nearly oval when mature; flowers in heads 1-2' long; banner obovate, slightly arched remotely from the keel, erect part 1½'' high, sides reflexed ½'' deep, blade longer than the keel; keel straight, tip round and obtuse; calyx teeth triangular, about ½ the tube; pedicel shorter than the ovate, hyaline bract which is 1'' long; stipules small, adnate, not connate; leaves 3-4' long; leaflets 12-15 pairs, elliptical to ovate, obtuse, short-petiolulate, about 4'' long but variable. Common on the table land above Fallbrock, Calif., to Los Angeles Closely allied to A. Crotalariæ. The type is from my collection of 1882.

A. Crotalariae (Bth) Gray is the var. virgatus Gray Bot. Cal. 1 149.

Var. **Magdalenae** (Greene Pitt. 1 162). A. Magdalenæ Greene l. c. A. candidissimus (Bth.) Wats.

Var. **Menziesii** (Gray Proc. A. A. 6 217). A. Menziesii Gray l. c. A. Franciscanus Sheld.

Var. **anemophilus** (Greene Bull. Cal. Acad. 4 186) A. anemophilus Greene l. c. A. miguelensis Greene. A. vestitus (Bth.) Wats.

A. vallaris n. sp. Pods capitate, 1½' long, 6'' wide, 4'' high, deeply sulcate dorsally, much obcompressed in the middle but with prominent and laterally flattened tip, smooth, acute at both ends, arcuate to ⅓ circle, general outline normally elliptical-lanceolate, dorsal suture intruded ½'' deep in the middle, stipe 6'' long and much enlarged at tip; flowers few, white, in a short head, 9'' long; banner gently arched to 45 degrees, 1'' beyond the calyx tips, lanceolate, sides reflexed ½'' wide and most at the tip, and so making the banner appear very narrow above; wings linear, 1'' wide, fully 1'' longer than the keel, narrowed at tip,

a little ascending; keel gently rounded from base to tip, 3'' long, tip erect, blunt, purple, about the shape of that of A. amphioxys; calyx tube cylindrical, 2½'' long, obliquely inserted, straight, nigrescent; teeth subulate, 1'' long; pedicels 1'' long, stout, erect in flower and reflexed in fruit; bracts ovate, 1'' long; peduncles sulcate, straight, 2' long, slender, floral rachis about ½' long; leaves 3' long, the petioles of the upper ones about as long as the lower leaflets; leaflets elliptical-cuneate, mostly emarginate, petiolulate, 6-9'' long, 3-4'' wide, 7-9 pairs, thin, contiguous; stipules very small, not connate, ovate, green, adnate, 2'' long above and 1'' long below; stems 1-2° long, tufted from a woody root, sulcate, erect but weak and flexuous; lower internodes about 3' long, the upper 6-12'' long; pubescence very scanty, appressed, of slender and tapering hairs. Eastern Oregon, in Snake River Canyon, near Ballard's Landing, Cusick. Belongs to the A. arrectus group and nearest to A. scaphoides. More material just received shows pods rugose, reflexed, stipe often 1' long, septum intruded even 2'' deep.

An examination of the type A. arrectus Gray shows that the southern plants referred to it by Watson belong to a closely allied species whose extreme form is represented by A. eremiticus Sheldon, with almost papery pods. The intermediate form given below could be referred to either species equally as well, as it has the pods nearly of the former and the leaves and habit of the latter. There may be intergrades but the writer has seen none in twenty years' field work. In fact none are known between this form and A. eremiticus but they are to be expected. Should none occur the following variety may be known as **A. Spencianus.**

A. eremiticus var. **Spencianus** n. var. This is what has heretofore been regarded as the type of A. arrectus, but that species belongs to the Leibergi-Palousensis group and probably includes both those species. The present variety is the characteristic form of eastern Nevada. Pods barely obcompressed, coriaceous and rather rugose, narrowly oblong, 7-12'' long, 2-2½'' wide,

often purplish, somewhat keeled ventrally, cuspidate, abruptly contracted at base into a tapering stipe as long as or double the calyx, sharply acute at both ends, tip not oblique, cross section reniform, dorsal sulcus deep, septum going to the middle, ventral suture rather thin, beak sharp; flowers apparently in heads, white; petals double the calyx, 7'' long; calyx tube from about horizontal to reflexed in fruit, tubular-campanulate, nigrescent, gibbous, deeper cleft above, hyaline; teeth rather short and slender but variable; pedicels reflexed, 2'' long, stout, ascending 45 degrees; bracts hyaline, lanceolate; peduncles 4-6' long; fruiting rachis 2-3' long and rather loosely fruited; leaves 5-8' long; leaflets thickish, 9-12 pairs, 6-8'' long, ovate, obtuse to retuse; stipules distinct, scarious; stems rather stout, 1-2° high, erect, sulcate, simple to branched, tufted, rather stout and flexuous, internodes 1-4' long; pubescence from nearly glabrous to ashy. The northern forms have narrower and more pubescent leaves and shorter stems.

A. diversifolius var. **roborum.** A. junceus (Nutt.) Gray Proc. A. A. 6 230.

A. Douglasii var. **piscinus** (Jones Cont. 7 645). A. piscinus Jones l. c.

Var. **Tejonensis** (Jones Cont. 7 645). A. Tejonensis Jones l. c.

A. reventus var. **conjunctus** (Wats. Proc. A. A. 18 371). A. conjunctus Wats. l. c.

A. Purshii var. **lectulus** (Wats. Proc. A. A. 14 471). A. lectulus Wats. l. c.

Var. **leucolobus** (Jones Zoe 4 270). A. leucolobus Jones l. c.

A. lotiflorus var. **Reverchoni** (Gray Proc. A. A. 19 74). A. Reverchoni Gr. l. c.

A. Francisquitensis var. **Lagunensis** (Jones Cont. 8 11). A. Lagunensis Jones l. c.

A. flexuosus var. **Fendleri** (Gray Pl. Fend. 36). A. Fendleri Gr. l. c.

A. Gibbsii var. **curvicarpus** (Sheld. Minn. Bot. Stud. 9 125). A. speirocarpus var. falciformis Gr. Bot. Cal. 1 152.

A. Hornii var. **Bahaeensis** (Sheld. l. c. 169). A. Bahæensis Sheld. l. c. var. minutiflorus Jones.

A. angustus var. **imperfectus** (Sheld. l. c. 19). A. ceramicus var. imperfectus Sheld. l. c. A. pictus var. filifolius Gray.

Var. **ceramicus** (Sheld. l. c. 19). A. ceramicus Sheld. l. c. A. pictus Gray.

A. leucopsis var. **fastidius** (Kell. Hesperian 1860). Phaca fastidia Kell. l. c.

Var. **asymmetricus** (Sheld. l. c. 19). A. asymmetricus Sheld. l. c. A. leucophyllus T. & G.

Var. **curtipes** (Gray Proc. Cal. Acad. 3 103). A. curtipes Gray l. c.

A. Panguicensis (Jones Cont. 7 671) A. argophyllus var. Panguicensis Jones l. c.

A. argophyllus var. **castanaeformis** (Wats. Proc. A. A. 20 362). A. castanæformis Wats. l. c.

A. inflexus var. **glareosus** (Dougl. Hook. Fl. 1 152). A. glareosus Dougl. l. c.

A. atratus var. **phyllophorus** n. var. This is what has been regarded as the type of the species but the type is the var. stenophyllus Jones which therefore is a synonym along with its Sheldonian equivalent. Pods frequently a little curved, acutely and abruptly pointed; flowers scattered; banner broadly ovate from a narrow base; wings arched and oblong; keel tip incurved 100 degrees; calyx short-cylindric, 2'' long, barely gibbous, narrowed below, nigrescent, teeth broadly triangular, $\frac{1}{4}$ the tube;

pedicels 2" long, 3-4 times the bracts, ascending in flower; bracts minute; leaflets rather remote; stipules not connate, minute, broad and scale-like only at tip of the underground stems; stems tufted, decumbent. Nevada.

A. Orcuttianus var. **Gregorianus** n. var. This differs from the type in the larger flowers, peduncles with floral rachis about 1° long, leaflets obovate to obcordate. It simulates A. eremiticus, but the pods are much narrower. San Gregorio, Colorado Desert, California.

A. Kentrophyta var. **impensus** (Sheld. 9 118). A. viridis var. impensus Sheld. l. c.

Var. **rotundus** (Jones Cont. 7 650). A. tegetarius var. rotundus Jones l c.

Var. **Coloradoensis** n. var. Lee's Ferry, Arizona, on the Colorado river, June 16, 1890. Like typical A. Kentrophyta but pods 4" long, 2" high, half-oval-ovate, acuminate and pungently pointed; stipules not at all connate even below; leaflets very rigid and conspicuously needle-tipped.

A. lentiginosus var. **Idriensis** n. var. This very remarkable var. I took to be a new species but it is clearly an outlying form of this excessively variable species. It was collected at New Idria, Calif., by Miss Eastwood. Pods coriaceous, triquetrous by being much obcompressed, shortly stipitate, ovate-lanceolate, sparsely puberulent with white hairs, a trifle inflated, deeply sulcate dorsally to 1½" deep at base, not sulcate at tip, 2-celled except at tip, arcuate, a trifle narrowed below, shortly acuminate with pungent tip, ventral suture raised and wing-like in the middle, somewhat mottled, about 6" long, tip erect, cross-section V-shaped; flowers 4" long with slightly exserted claws, not arched, reflexed in fruit; banner elliptical, abruptly arched to nearly erect 1" beyond the calyx tips, erect part 2" long and the whole 2" longer than the keel, sides reflexed ½" deep in the middle, white spot striate-veined; wings linear, straight, about

½'' longer than keel, about ½'' wide, purple-tipped; keel gently arched from base to tip in about a half circle, obtuse, about 1'' wide, boat shaped; calyx hyaline, thin, ashy, cleft deeper above, upper side arched, lower side straight, base narrowed and inserted on lower corner; tube cylindric, 2'' long, teeth short and deltoid; bracts ovate, hyaline; pedicels shorter than the bracts; leaves 1-2' long, widely spreading; all but the lowest closely sessile; leaflets contiguous to imbricated, obovate, apiculate, 2-3'' long, about 10 pairs, ashy on the margins, thick, petiolulate; stipules stiff, green, reflexed, adnate, deltoid; stems prostrate, slender; internodes 1-3' long, smooth.

A. elegans (Hook. Fl. 1 144) Sheldon l.c. 154. If this name is to be changed it should be **A. minor** (Hook. Fl. 1 144).

A. curtiflorus (Rydb. Fl. Mont. 242). A. elegans var. curtiflorus Rydb. l. c. This is the plant long called A. oroboides var. Americanus and abounds in Colorado. It differs from A. elegans in the very small and dull flowers, pods in very long and rather dense racemes, and in congested leaflets. The writer has seen no intergrades with the true A. elegans, with which it has been confounded.

A. sinuatus Piper Torr. Bull. 28 40 is a synonym of the true A. speirocarpus Gray. Gray himself confused his type with the variety falciformis which is a var. of A. Gibbsii and not of speirocarpus.

A. sulphurescens Rydb. Torr. Bull. 28 36 is the normal and well developed A. nitidus Dougl. described by Hooker as adsurgens var. robustior Fl. 1 149 and though hardly deserving varietal rank may be known as var. **robustior** (Hook.)

A. drepanolobus var. **aberrans** n. var. Pods 6'' long, 2'' high, a little arched, a little sulcate, on a slender stipe which is 1'' long, glabrous only when ripe. Columbia Basin.

A. Kaibensis n. sp. Like A. Episcopus Wats. which is the same as A. lancearius Gray, but pods broadly lanceolate-oblong,

not oblique at either end, sessile, circular to a little oblate in cross section, 9-15" long, 3" wide, conical beaked; leaflets none to 2-4 pairs. Gathered at House Rock, near Lee's Ferry, northern Arizona, June 18, 1890, Jones.

A. diphacus var. **peonis** n. var. This differs from the type in being prostrate with ascending tips, silvery-hoary throughout, leaflets about 8 pairs and 3" long. It appears to be very different from the type but there seem to be intergrades, while the species is known to be variable. Zacatecas, Mex., Jones, 1892.

A. agrestis var. **polyspermus** (T. & G.) A. Hypoglottis var. polyspermus T. & G. Fl. 1 328. A. virgultulus Sheld. Minn. Bot. Stud. 9 165. This hardly deserves varietal rank.

A. simplicifolius var. **spatulatus** (Sheld. Minn. Bot. Stud. 9 19.) A. spatulatus Sheld. l. c. A. cæspitosus Gray.

A. Pattersoni var. **praelongus** (Sheld.) A. prælongus Sheld. Minn. Bot. Stud. 9 19. A. procerus Gray Proc. A. A. 13 369.

A. Shortianus var. **cyaneus** (Gray). A. cyaneus Gray Fl. Fend. 34. A. Shortianus var. minor Gray Proc. A. A. 6 211.

A. Antiselli var. **phoxus** n. var. Plants with the habit of A. leucopsis var. curtipes, shrubby below, stems apparently 2° or more high, ashy-white, rather stout, 2" thick; leaves minutely pubescent with short appressed hairs fixed by the base, sessile or with petiole little longer than the lowest leaflet, 6' long, the lower ones smaller; leaflets 12-14 pairs, nearly contiguous, 6" long, elliptical-oblong, retuse to rounded, not conspicuously reduced toward end of leaf; stipules very small, deltoid, adnate, not connate; internodes 1' long or less, rarely more; peduncles and stems deeply sulcate, the former 6-12' long, straight and stout, racemosely flowered on the upper third; pedicels 1" long, as long as the campanulate calyx, three times as long as the minute and ovate bract, reflexed in flower and fruit; calyx white, hyaline; subulate teeth half shorter; flowers 7" long, straight, with petals on exserted claws; keel surpassing the tube by 4".

straight, tip sharply incurved to 110 degrees, 1½" high, with very short, erect, blunt not dark point; wings linear-oblanceolate, nearly 1" longer than keel and much narrower, little arched; banner 2" longer than the wings, arched to 80-90 degrees, sides reflexed, 1" wide in the middle only; fruit pendulous, 3" high, ½" wide, 1-1½' long exclusive of the 6"-long filiform stipe, smooth, flat, from half-oblanceolate to linear-elliptical, the sutures either equally arched or the ventral more so, acuminate at base, triangular apiculate at tip; flowers 15-20; leaflets never hoary below, nearly glabrous above. This differs from A. Antiselli in the long, large and narrow pod, etc. It approaches A. filipes Gray more nearly than the type does. A. Antiselli seems to have been confused with A. trichopodus by Gray as his specimens from the Santa Clara Valley, Calif., are referred to that species in the Gray Herbarium. These specimens have broader and blunter pods and longer stipe in proportion.

A. tegetarioides n. sp. No. 2619 Cusick, southern Blue Mts., Oregon, in sandy soil on the Buck range, June 28, 1901. Pods about 2" long, double the calyx, 1" high, ½" wide, elliptical, abruptly apiculate at both ends, minutely stipitate, splitting the calyx, chartaceous, coarsely reticulated, laterally compressed, ashy with appressed hairs, widely spreading, completely 1-celled, not inflated, few ovuled, 1-seeded, sutures nerve-like, sides concave, cross section unequally 4-angled by the dorsal side being bisulcate and with the raised suture between; flowers racemose, 3-5, spreading, slender, white, with banner purple striped in the middle and keel dark-tipped, about 2" long, banner oval, not hooded, abruptly arched at end of teeth to erect, emarginate, fully 1" long, sides much reflexed; wings broadly obovate and very oblique, wider than keel and ½" longer, ½" shorter than the banner; keel barely surpassing the calyx teeth, rounded from base to tip into a half circle, obtuse, about ½" wide; calyx turbinate-campanulate, tube about ½" long, with mouth not oblique and base narrowed and obliquely inserted on a filiform and ascending pedicel which is at least as long as the tube; teeth

subulate, lax, ¾'' long; bracts lanceolate, shorter than the pedicels; peduncles axillary throughout, filiform, about ½' long; leaves about 1-1½' long, the filiform petiole over half the whole; leaflets thick, about 4 pairs, nearly contiguous, 2-2½'' long, obcordate to oval-obcordate, with cuneate and long-petiolulate base; truncate to emarginate, folded; stipules not connate, triangular-acuminate, rather large, green above; stems very many, prostrate, much branched, cæspitose, in small mats; nodes very many and knotty; internodes very short; stems perennial from a simple-crowned root. This has the appearance of A. lentiformis largely as to pods and habit, and also reminds one forcibly of A. Kentrophyta var. tegetarius.

A. Alvordensis n. sp. No. 2583 Cusick, gathered in the desert of Alvord Valley, eastern Oregon, June 18, 1901. Pods chartaceous, reticulated, somewhat mottled, laterally compressed till nearly flat and vetch-like, triangular-acute at both ends, 2'' high, about 1' long, tightly incurved into a circle, reflexed, sometimes sulcate dorsally, completely 1-celled, puberulent, not inflated, on a stipe about 3'' long and triple the calyx, sutures nerve-like; flowers barely 3'' long, slender, purple-veined, widely spreading, racemose, 3-8 (and pods 1-3); banner ovate, arched abruptly beyond the calyx teeth to 90 degrees, about 1-1½'' long, sides much reflexed; wings lanceolate, narrow, abruptly arched near the end of keel to 45 degrees, about ½'' longer than keel and 1'' shorter than banner; keel base straight, 1½'' long, tip abruptly arched to erect, blunt; all petals purple-veined; calyx turbinate-campanulate, about 1'' long, 5-nerved, deeper cleft above and oblique at mouth, narrowed and obliquely inserted at base; teeth minute and deltoid; pedicels not half the calyx tube; peduncles ½-1' long, filiform, axillary throughout; leaves 1½' long, narrow; petiole about 2-3'' long; leaflets 2-3'' long, 6-8 pairs, obovate-cuneate, long-petiolulate, emarginate, thick, folded, not quite contiguous; stipules minute, triangular, green, not connate; stems very slender, flexuous, erect, much branched, less pubescent than the leaves, 6-15' long, many, perennial.

This remarkable species has the flowers of A. Geyeri nearly, the slender habit of A. Howellii, and the pods of A. speirocarpus, though smaller.

A. arrectus var. **Leibergi.** A. Leibergi Jones Cont. 7 663.

Var. **Palousensis** (Piper). A. Palousensis Piper Bot. Gaz. 22 489.

A. Leibergi is a remarkable form appearing distinct but cannot be kept up. It is characterized by subscapose and very long peduncles, almost filiform leaflets and is nearly acaulescent. A. Palousensis hardly deserves varietal rauk. It is characterized by slender stems nearly a foot long and by wide leaflets when mature.

A. Newberryi var. **Watsonianus** (Kuntze). Tragacantha Watsoniana Kuntze Rev. Gen. 2 942.

A. Hypoglottis var. bracteatus Osterhout Torr. Bull. 26 256 is an abnormal form of A. agrestis growing in the shade and with stems protected by dead leaves so that they developed abnormal stipules and bracts.

A. brevicaulis Nelson Torr. Bull. 26 9 is the normal fully developed form of A. calycosus Torrey.

A. junciformis Nelson Torr. Bull. 26 9 is A. diversifolius Gray.

A. exilifolius Nelson Torr. Bull. 26 10 is one of the infinitessimal subdivisions of A. simplicifolius Wats.

A. aculeatus Nelson Torr. Bull. 26 11 is another similar form of A. Kentrophyta.

A. Cusickii Rydb. (not Gray) Torr. Bull. 26 541. A. Malheurensis Heller Cat. N. A. 2 Ed. 7 is A. arrectus Gray.

A. Kelseyi Rydb. Fl. Mont. 241 is a well developed form of A. terminalis Wats.

A. reventoides Jones Cont. 7 661 is probably only a form of A. terminalis Wats. with shorter pods and broader leaflets.

A. sericoleucus var. **tridactylicus** (Gray). A. tridactylicus Gray Proc. A. A. 6 527. It is evident that this is only a well marked variety as there are all sorts of intergrades in peduncles, leaves and pods. The var. aretioides is an intermediate form.

A. scaphoides (Jones Proc. Cal. Acad. 2 5 664). A. arrectus var. scaphoides Jones l. c. A. scophioides Rydberg Fl. Mont. 241. The writer never published an A. scophioides.

Homalobus hylophilus Rydb. Fl. Mont. 247 is the wide-leaved form of Astragalus decumbens var. convallarius, growing in the shade.

In Contributions No. 7 p. 633 the writer found it impossible to see any reason in the Brittonian method of splitting up Astragalus into Phaca, etc., and showed the absurdity of putting certain very closely related species into separate genera. Now Rydberg in Fl. Mont. p. 242, 243, 245, 246, carries this still farther by putting A. elegans, Americanus and aboriginum in three genera though they are intimately related species, far more closely so than A. aboriginum and A. tenellus which he keeps in the same genus. By this method specific and generic characters are no longer a question of genetic relationship but rather are determined by the personal equation. The next step will be the creation of a botanical Pope, who shall decide whose botanical intuitions are true and whose spurious.

ZOE. It is a great pleasure to western botanists to see Zoe again. It is to be hoped that the Brandegees will find the necessary time to continue its publication, though the duties of conducting such a journal are arduous. Zoe is the only botanical journal on the Pacific Coast that has had the courage of its convictions and the will to express them. Its immediate predecessor, now happily defunct, in its later days consisted chiefly of a cover and an urgent appeal to subscribers to pay up, which was sufficiently indicative of the estimate which the botanical public had for a journal that never had an opinion on any important controversial subject.

NOTES ON ONION MARKINGS.

There is a tendency in the hæmatochiton-platycaule groups to have the two membranes of the coats separate, thus producing alternate coats with ribs and no markings and the others with markings and no ribs. In nearly all onions with special markings the ribs are on the delicate outer membrane only and soon disappear. They seem to be on the main coat in the Douglasii group.

The platycaule-Douglasii groups evidently develop transversely-oblong meshes (acute at both ends) at times, and this accounts for the too many species in these groups, but the true limitations of the species cannot be given without more field study. The faint markings on the outer membrane of the Douglasii group coupled with the variable development of anceps markings at the base of the coat will probably settle the status of these species if the markings are constant as they seem to be.

Page 9, A. anceps, add "Found abundantly at Palisade, central Nevada." This species probably runs into A. Tolmiei. Markings of outer membrane about 1x1" or transverse when not about square. The ends of the meshes are bluntly triangular, thus making the meshes hexagonal.

The markings of A. Cusickii and what corresponds to A. Tolmiei are identical on the outer membrane with the same markings on A. anceps. The crests of A. Cusickii are peculiar in being triangular and small horns on the corners of the pod.

The markings on the outer membrane of A. pleianthum are vertically oblong with rectangular ends. The crests of this species are central and close to the style.

It remains to determine to which class true A. Douglasii belongs, but the probabilities are in favor of Tolmiei.

The markings of A. platycaule on the outer membrane are those of A. pleianthum but nearly linear, the main coat has very

faint traces of the markings of A. anceps outer membrane, and the sepals are constricted over the ovary.

Onions having meshes like grass-nerves are A. hæmatochiton, validum, cernuum, lacunosum, stellatum, and probably scaposum.

Onions having branched ribs are A. Parryi, Lemmoni, atrorubens, parvum, Douglasii, ambiguum, stellatum, macrum, campanulatum and bisceptrum.

Such species as A. Parryi, atrorubens, decipiens, fimbriatum, and perhaps cristatum are probably without special markings, the markings given being those of the outer coat, but these are serviceable in determining the species because of their relative size.

The markings of A. ambiguum to A. obtusum are possibly those of the outer coat only though they are unusually strong for such markings. There are no other meshes.

The markings of A. serratum, attenuifolium, hyalinum, and peninsulare are the longest in the genus, being from 8-16" long, and rarely over 1" wide, under the same enlargement. The markings of A. Bolanderi, madidum, and collinum are similar but run from 4-8" long and ½-1" wide, under the same enlargement. The walls of the meshes of A. attenuifolium, hyalinum and Bolanderi are very delicate and thin, the most so of any special markings of our onions, though equaled in fineness by the markings of the outer coats of most onions, these latter coats are very thin and have meshes which are rectangular or nearly so except in A. acuminatum and Bolanderi which have very much distorted meshes (for which see the figures).

A. acuminatum Hooker. Watson represents this species as having the walls of the meshes composed of 3 lines, but this is an optical illusion, the walls are solid, wide, apparently flat on the top but really beaded; the outer coat is yellowish and rigid; sepals purple-tipped, always paler below, rigid, carinate in fruit; filaments subulate: bulbs always close to the surface.

Key to the Onions by Markings of Bulb Coats.

MAGNIFICATION FORTY DIAMETERS.

A. Ribs not branching into equal divisions and not forming diamond-shaped and very large meshes.

AB. Meshes unknown.

ABC. Obscure species—collinum, scilloides, Bidwelliæ.

AB2C. Meshes probably absent on main coat and rectangular on its outer lining—fimbriatum, Hendersoni, Douglasii, crenulatum, Breweri, falcifolium.

A2B. Main coat without markings. Outer lining with nearly rectangular and very faint markings.

A2BC. Meshes vertically-oblong to nearly square.

A2BCD. Meshes unknown but probably coming here—crenulatum, ribs many; meshes known—Parishii, ribs few.

A2BC2D. Meshes not over 2" long by 1½" wide.

A2BC2DE. Ribs many, with a few lateral nerves—pleianthum var. particolor, meshes 1½-2 by 1-1½"; parvum, meshes 1¼-2 by ½", ribs with a few lateral nerves; Douglasii. ? pleianthum, meshes 1½-2 by ½-1", base with the markings of anceps but vertical.

A2BC2D2E. Ribs few—decipiens, meshes 1-2 by ¾"; cristatum probably the same; Parryi, meshes 1½-2 by ½-1", ribs with a few lateral nerves; Parishii, probably the same; atrorubens, meshes 2-2½ by 1", ribs with a few lateral nerves.

A2B2C. Meshes transversely oblong to nearly square.

A2B2CD. Meshes rectangular or nearly so—platycaule, meshes $1\frac{1}{2}$-2 by 1", ribs with a few lateral nerves.

A2B2C2D. Meshes six-sided—Douglasii ?
Tolmiei, meshes 1 by 1"; Cusickii, meshes 1 by 1".

A3B. Main coat distinctly marked with meshes at least at base.

A3BC. Meshes straight and with straight and not wavy sides.

A3BCD. Meshes with nearly rectangular ends.

A3BCDE. Meshes vertical.

A3BCDEF. Meshes linear.

A3BCDEFG. Bulbs with a rootstock—validum, meshes 7-9 by $\frac{1}{2}$", on outer membrane of coat 3-4 by 1"; brevistylum, meshes 3-7 by $\frac{2}{3}$"; Plummeræ, meshes probably similar.

A3BCDEF2G. Bulbs without a rootstock—Sibiricum probably; cernuum, meshes 5-9 by $\frac{3}{4}$-1", outer membrane of it 10 by 1-$1\frac{1}{2}$"; hæmatochiton, meshes 7-12 by $\frac{1}{4}$-1", outer membrane 3-5 by 1"; stellatum, meshes sometimes linear and 5-7 by $\frac{3}{4}$", also 5-7 by $1\frac{1}{6}$-$1\frac{1}{2}$" and on outer membrane $1\frac{1}{2}$-2 by $\frac{2}{3}$"; lacunosum, meshes nearly linear, 4-6 by 1-$1\frac{1}{4}$", on outer membrane 2 by $\frac{1}{2}$-1" and sometimes transverse.

A3BCDE2F. Meshes oblong.

A3BCDE2FG. Meshes large—scaposum, meshes rectangular at the ends, 2-3 by 1", according to Watson 4 by 2"; stellatum, ends of meshes mostly oblique, 5-7 by $\frac{3}{4}$-$1\frac{1}{2}$", on outer membrane $1\frac{1}{2}$-2 by $\frac{2}{3}$", ribs with a few lateral nerves; Bigelovii, meshes with ends often curved, 5-$5\frac{1}{2}$ by 2".

A3BCDE2F2G. Meshes small—decipiens, (sometimes the main coat seems to be marked) $\frac{1}{2}$ by $\frac{3}{4}$"; cristatum, the same probably; atrorubens, meshes seem to be present on the main coat at times, 2-$2\frac{1}{2}$ by 1"; falcifolium may belong here.

A3BCD2E. Meshes transverse, often unevenly six-sided, plants

apparently allied to the tribracteatum group—minimum, meshes 2-2½ by 1", near the base they are almost regularly rectangular and vertical, 1½-2 by ¾-1", outer membrane 1-1½ by ½-1" and mostly hexagonal and transverse; simillimum seems to be about the same; obtusum probably comes here.

A3BC2D. Meshes with triangular ends and therefore hexagonal but ends much shorter than the sides, oblong to linear.

A3BC2DE. Meshes vertical—parvum may develop such meshes at base, either the outer membrane or the main coat has meshes rectangular to hexagonal and 1¼-2 by ½"; parvum var. Brucæ, meshes large, ¾ by 1½-2", near the base they are 2-3 by ¾-1", outer coat ¾-1", and transversely rectangular.

A3BC2D2E. Meshes transverse.

A3BC2D2EF. Leaves broad.

A3BC2D2EFG. Plants of the Sierra region—anceps, meshes 3½ by ½" and linear, according to Watson 4-5 by ½-⅔"; Lemmoni, ribs with a few lateral nerves, meshes 3-4 by ½-¾" and linear to 2-2½ by ¾-1" and oblong; ambiguum, meshes 3 by 1", rarely 4 by 1", near base 2-3 by 1-1½" and vertical; ribs with a few lateral nerves.

A3BC2D2EF2G. Plants of the interior from Utah to eastern Oregon and northward, meshes oblong—anceps var. aberrans, meshes 2½-3 by 1"; Brandegei, meshes 3 by ¾-1", also 2½-3 by ¾-1", the form called miser has meshes 1½-3 by ⅓-⅔".

A3BC2D2E2F. Leaves not broad. Plants of the Utah to eastern Oregon region except tribracteatum—tribracteatum, meshes according to Watson with the upper side longer than the lower and ends often rounded, about 3 by 1½"; tribracteatum var. Diehlii, meshes symmetrical, 3-4 by ½", sometimes 3-4½ by 1-1½"; macrum, meshes 4-5 by ¾", ribs with few lateral nerves, the form of this called Nevii has meshes ¾ by ½-1".

A3BC3D. Meshes with rounded or bluntly triangular ends, broad, small, transverse—minimum, meshes 2-2½ by 1", at base 1½-2 by ¾-1", rectangular and vertical, outer coat with ends irregularly rounded, and broad but regular meshes, 1-1½ by ½-1"; similimum also probably; obtusum probably.

A3B2C. Meshes conspicuously not straight, serrate to contorted.

A3B2CD. Meshes horizontally serrate by being bent most and abruptly near the middle, linear and very long, triangular or nearly so at the ends, sides nearly parallel.

A3B2CDE. Sides without crinkles—serratum, meshes quite regularly and abruptly bent, 12-16 by ¾-1", according to Watson 12 by 1⅓", outer membrane inclined to separate from the main one; hyalinum, meshes 8-10 by ½-1" and bend more flowing, near the ends meshes 4-6 by ¾-1", and ¾ by ½-1", outer membrane 1-2 by 1" and vertically oblong.

A3B2CD2E. Sides with a few crinkles only—attenuifolium, meshes with flowing bend, 10 by 1", 10-12 by ¾-1," rarely 7 by 1½-2" and with an unusual number of crinkles, outer membrane 2-4 by ¾" and vertically-oblong with rectangular ends, inclined to separate from the main coat; unifolium, meshes not so uniform, abruptly bent in the middle, 5-7 by 1-1½", bulb said to be peculiar: peninsulare might be sought here, but the meshes are curved most at the ends and little in the middle and though they form serrations it is at the ends and not in the middle, meshes 10 by ¾", farther up 6-10 by 1"; on outer coat 2-3 by ½-¾", vertical and rectangular.

A3B2C2D. Meshes linear or nearly so, irregularly contorted or running obliquely and variously bent, not crinkled.

A3B2C2DE. Meshes not forming any definite figure and thereby not repeating themselves—Bolanderi, meshes 4-8 by ¾-1", plants of northern California region; madidum, meshes 4-8 by ½-1", plants of eastern Oregon and Idaho.

A3B2C2D2E. Meshes forming nests or obscure serrations—madidum, sometimes has the meshes arranged in serrations in the middle of the coat; peninsulare, meshes running obliquely and together making serrations, 10 by $\frac{3}{4}$", farther up 6-10 by 1", upper ones 3-4 by $\frac{3}{4}$-1" and these vertical, on outer coat vertical and 2-3 by $\frac{1}{2}$-$\frac{3}{4}$" and rectangular; fibrillum, ends of several meshes joined by a common line and much contorted into nests, or meshes arranged like a labyrinth, becoming fibrous with age, 7 by $\frac{1}{2}$", or 4-6 by $\frac{1}{2}$-$\frac{3}{4}$"; Sanbornii may come here.

A3B2C3D. Meshes neither narrow nor regular (except that they are nearly regular in acuminatum).

A3B2C3DE. Mesh walls not crinkled, thick—Nevadense, meshes 2-3 by $\frac{1}{2}$-$1\frac{1}{2}$", toward the top they are nearly rectangular and vertical, $1\frac{1}{2}$-2 by $\frac{3}{4}$-1".

A3B2C3D2E. Walls of the meshes minutely and densely crinkled, at least the vertical ones.

A3B2C3D2EF. Meshes nearly regular, from hexagonal to rectangular, most of them transverse, but nearly as high as wide, equally crinkled—acuminatum, meshes large, nearly hexagonal, much raised, 5-6 by $2\frac{1}{2}$-3" walls coarse, inner membrane with transversely-oblong, rectangular, fine meshes $\frac{1}{2}$ by $\frac{3}{4}$-1" and walls straight, outer membrane with very irregular meshes like those of Bolanderi and not crinkled, 2-3 by 1" and with delicate walls; Palmeri, meshes rather obscurely quadrangular, walls fine, 3-6 by 1-2", according to Watson 2-3 by $\frac{1}{2}$-1".

A3B2C3D2E2F. Meshes never regular, the vertical walls deeply crinkled, the lateral walls much less so and often almost without waves; ribs with a few lateral branches, campanulatum, walls of meshes coarse, very deeply crinkled, meshes 2-3 by 1-$1\frac{1}{2}$", toward the top vertically oblong and 2-6 by 1", flowers lead-purple, low plants with narrow leaves, growing

at high elevations in the Sierras; bisceptrum, walls of meshes less deeply crinkled and not so coarse, meshes 2-3 by 1-2", near the top shoe-shaped 2-2½ by 1", flowers white to pink, tall plants, with wide leaves, growing at middle elevations, Nevada to Utah; Sanbornii may come here.

2A. Ribs branching into equal divisions and uniting to form large and diamond-shaped meshes, the interspaces filled with a delicate membrane which has large, vertically oblong and rectangular meshes.

2AB. Plants producing bulblets freely among the flowers, pedicels filiform and sinuous—Canadense, thin membrane with meshes 1½-2 by 1-1½", hexagonal, ends often oblique, bulblets large, rather coarse plants; Geyeri, slender plants, bulblets small; Geyeri var. tenerum, very slender plants of swamps, main meshes 10-13 by 3-4", bulblets small.

2A2B. Plants rarely if at all producing bulbets, pedicels not sinuous—reticulatum; reticulatum var. deserticola, main meshes 22 by 7", outer coat 5 by ½-¾"; mutabile; Nuttallii, meshes of membrane 1-1½ by 1", main meshes very large.

NOTE—Unless otherwise stated the onion markings figured are from the center of the coat.

ERRORS—Page 31, Allium lacounsum should be lacunosum.
Page 51, last line, A. angustifolia should be linearis.

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APPENDIX.

The author regrets the necessity for the scrappy character of Contributions No. 10 In explanation will say that the body of the paper was printed last December. It early became evident that plates would be needed for the onions. The long delay in the preparation of the plates gave the author time to accumulate much material and some notes toward clearing up certain ambiguous species. The results were recorded under "Addenda" along with the changes of view caused by the new material. A revision of certain groups of the Nyctaginaceæ of our region was added along with certain changes and new names in Astragalus. An unexpected opportunity to make an extended trip to the coast through Oregon, Washington and Nevada caused the author to distribute that part of the Contributions already printed and to reserve the plates and notes for the Appendix.

The author wishes to acknowledge his obligation to Mr. Diehl the printer, and editor of the Mammoth Record for assistance in proof reading and tests of the MS. in my herbarium by actual analysis of all the species of onions, using the key and descriptions of this Contribution.

Allium Californicum Rose is certainly only a form of A. hæmatochiton.

A. Hendersoni R. & S is a form of A. Douglasii for the stamens are not always exserted. The peduncle is double the leaves as in the other Idaho forms. Have seen duplicate types.

A. falcifolium var. **Breweri** (Watson), A. Breweri Wats. Proc. A. A. 14 233. This is manifestly only a broader sepaled form of falcifolium. The serrations of the sepals are either absent or present on both forms. The species combines the characters of A. Douglasii and platycaule, but can be kept separate

by the serratures when present, the variable sepals and crested ovary. The sepals are not constricted over the ovary as in A. platycaule. The so-called species A. falcifolium Breweri, platycaule, Douglasii, Tolmiei, Cusickii, pleianthum and Hendersoni all grow on the same kind of soil and in similar situations, a very barren clay or decomposed porphyry, on bare slopes or knolls which are well drained. They prefer shallow soil on flat rocks. The first two grow in the Tropical Zone as to climate; the third in the upper Temperate near the alpine, and the others in the lower Oak or middle Temperate.

A. parvum is put with this group because of the bulb character but the writer did not intend to say that it is not a well marked species.

A. parvum var. **Brucae** is common in the Sierras and has been collected and distributed by Congdon as A. obtusum Lemmon.

A. serratum var. **dichlamydeum** (Greene), A. dichlamydeum Greene Pitt 1 165. This is a well marked variety with very broad and abruptly acute sepals. Have seen duplicate types.

A. unifolium Kell. is very close to A. peninsulare Lemmon. Its peculiar character of root is imaginary. The root is no more a coated corm than many other onions. There are few scales and a solid center as in A peninsulare, falcifolium, etc. The stem is peculiar in coming from a horizontal ovate bulb, and continues horizontal for about two inches and then turns upright. At the bend it roots and forms a new bulb. This character favors its spreading underground.

A. Bolanderi as to its root is liable to be taken for a corm also as it propagates by the production of a new bulb from the lower corner of the old one, and as both bulbs are alive it makes the root seem oblong and something like a rootstock or short corm. The markings place it near to the peninsulare group, but they are variable.

A. lacunosum Watson was correctly placed by Watson in

the bisceptrum-acuminatum group. The bulb scales sent me from the type were the outer membrane only and not the main coat, in addition they were probably taken from the upper part only as the meshes are too long. The true markings are given in the last plates. This species which is manifestly a close congener to and the representative of A. acuminatum on the Coast, has very similarly pitted coat, but the outer membrane has the rectangular meshes given in the plate as those of A. lacunosum. Mrs. Brandegee found this species growing at Tehachapi, so it is not an insular onion exclusively. The true A. acuminatum occurs in the Sierras.

A. bisceptrum has a closer relationship to several species in the Sierras than is usually supposed and is not always easily separable from them. The writer himself has confused two of these species. It blooms at least two weeks later than A. Austinæ and is a robust plant with succulent leaves which are broad and long. A. campanulatum is probably a similar but still more robust plant with larger flowers.

A. campanulatum Wats. Plants found by Congdon in the Sierras correspond perfectly with the description as given on page 15 No. 24. This is a robust plant $1\frac{1}{2}$-2^c high, with the delicate sepals of the unifoliu n-attenuifolium groups, and with large flowers. The markings of the bulb coats place it with A. bisceptrum.

A. Austinae n. sp. This is what the writer has hitherto taken for the true A. campanulatum and is fully described on page 26 No. 52. The flowers are rotate. The crests are quite variable but very prominent. They cover the entire tip of the ovary and spread out from it like a rotate corolla the whole being over one-half wider than the ovary. They are often dark-purple and spread the filaments widely. The species abounds by millions at Summit and Castle Peak (Mt. Stanford) in the Sierras on gravelly ridges along with A. obtusum.

A. stenanthum Drew is A. serratum.

A. Hickmanni Eastwood ined is a low form of A. peninsulare. Have seen the type.

A. crispum Greene is A. serratum. Have seen the type.

A. Inyonis n. sp. A. decipiens Jones page 16. Not A. decipiens Fisher Regl. Mon. 245.

A. obtusum Lemmon occurs abundantly on the slopes of Castle Peak (Mt. Stanford) along with A. Austinæ. Like the Utah A. Diehlii this species has the ovary covered by thick, triangular, rather large, 2-lobed crests, set close around the style. These run down the ovary from one-third to its whole length. The leaves are 2-3" wide, lunate in cross-section, not falcate, when dry are very thin. It propagates by fission. It is much like A. tribracteatum. The specimens of Lemmon's type distributed have but one leaf. It seems to occur on the banks of the Columbia also (Howell). It is the same as A. concinnum K. Brandegee ined.

A. tribracteatum Torr. It is quite possible that this species is the same as A obtusum Lemmon and that Watson took his bulb coat markings from the Utah species, A Diehlii, which he erroneously referred to it, for he certainly was in great doubt as to what his species was since he referred A parvum to it also. In addition A. tribracteatum was collected in the region near Summit, Cal. where A. obtusum abounds, but the A. tribracteatum of Watson never seems to have been collected by anybody there or anywhere else, if his published markings belong to Torrey's type.

A. Diehlii n. sp. A. tribracteatum var. Diehlii page 18 No. 34. This is too widely separated from A. tribracteatum to be placed under it as a variety. In addition there is great uncertainty as to what the species is.

A. Palmeri has been collected by Brandegee in the Sierras at Kernville.

Abronia alpina Brandegee. After seeing the type the writer has no hesitancy in considering it distinct.

Astragalus serotinus Gray has been carefully studied in the field by the writer this season, with the result that he now regards it as not a form of A. decumbens. (See page 58).

A. curtiflorus (Rydb.) page 64 should have been printed as **A. minor var. curtiflorus (Rydb.)**

A. Pasqualensis n. sp. Santiago Pasqualo, Durango, Mex. Palmer, No. 398, April to May, 1896. Perennial from a rather shrubby base. Ascending stems slender and flexuous, angled, branched, about a foot high, with short internodes ½-1' long; leaves about 2' long and proper petiole about ¼' long; leaflets 3-4 pairs, rather distant, alternate, 1' long, long-petiolulate, barely acute at the rounded tip, linear-oblanceolate, 2'' wide, about 3'' apart, the pairs ½' apart, white-pubescent with very closely appressed hairs fixed by the middle; stems less pubescent than the leaves, but plant pubescent throughout except the petals; stipules very small, adnate, not connate; proper peduncles about 1' long and with a well developed rachis 2' long; flowers purple apparently, ascending, reflexed in fruit, short-spicate, nearly sessile, about 4'' long; triangular-subulate bracts about 1'' long; calyx tube short-campanulate, 1'' long, teeth subulate and as long as tube; banner broad and short, about as long as the wings and keel; wings probably broad and enlarged: keel large, acute, the tip ascending about 45°; pods linear, very acute, straight, 2-celled, about 1' long and 1'' wide; fruiting pedicels stout, 1'' long. This is evidently a close congener to A. Arizonicus.

A. pectinatus var. **platyphyllus.** (See fig.) Pods very thick and with very prominent and raised sutures when dry; leaflets broad. Collected by Prof. A. Nelson in Wyoming.

A. agrestis var. **bracteatus** (Osterhout). A. Hypoglottis var. bracteatus Osterhout Bull Torr. Club 26 256.

A. Nevinii var. **Traskæ** (Eastwood). A. Traskæ Eastwood Proc. Cal. Acad. 3 102 fig.

A. Webberi var. **cibarius** (Sheldon). A. cibarius Sheldon Bull. Minn. Bot. Stud. 9 149.

INDEX TO PLATES.

The onion plates are grouped in pages of eight plates each. and each plate is numbered to correspond with the number of the species in the text. No. 52 should be changed to A. Austinæ. A. decipiens should be A. Inyonis.

Among the Astragali, etc., the plates are numbered consecutively.

PLATE I.

Astragalus simplicifolius and the vars. cæspitosus and spatulatus.
A. Kentrophyta and the vars. Coloradoensis, rotundus, and impensus.
A. sericoleucus and the vars. aretioides and tridactylicus.
A. humistratus and the vars Sonoræ, tenerrimus and Hosackiæ.
A. flexuosus and the vars. Fendleri and elongatus.
A. diversifolius.
A. Ibapensis.

PLATE II.

A. diversifolius var. roborum.
A. serotinus.
A. decumbens and the form called tenuifolius.
A. lancearius and its synonym A. Episcopus.
A. Kaibensis.
A. Alvordensis.
A. Antiselli and the var. phoxus.
A. Mulfordæ.

PLATE III.

A. tegetarioides.
A. minor and the var. curtiflorus.
A. Pattersoni and the var. prælongus.

PLATE IV.

A. pectinatus and the var. platyphyllus.
A. Panguicensis.
A. Shortianus and the vars. minor and cyaneus.
A. inflexus.

PLATE V.

A. inflexus var. glareosus.
A. Purshii and the vars. tinctus, leucolobus and longilobus.

PLATE VI.

A. Purshii var. lectulus.
A. Newberryi and the vars. castoreus and Watsonianus.
A. diphacus and the var. peonis.
A. agrestis.

PLATE VII.

A. agrestis vars. bracteatus and polyspermus.
A. leucopsis and the vars. asymmetricus and brachypus.

PLATE VIII.

A. leucopsis vars. fastidius and curtipes.
A. Hornii and the var. Bahæensis.
A. angustus, the form foliolosus and the vars. imperfectus and ceramicus.
A. lentiginosus var. Idriensis.
A. lotiflorus var. Reverchoni.

PLATE IX.

A. Douglasii vars. glaberrimus and piscinus.
A. Pomonensis.

PLATE X.

A. Douglasii and the vars. Parishii and Tejonensis.

PLATE XI.

A. Crotalariæ and the vars. Menziesii, anemophilus and Magdalenæ.

PLATE XII.

The form Miguelensis.
A. Gibbsii and the var. curvicarpus.
A. speirocarpus.
A. bicristatus and the var. tetrapteroides.
A. Orcuttianus var. Gregorianus.

PLATE XIII.

A. vallaris.
A. scaphoides.
A. arrectus and the vars. Leibergi and Palousensis and the form atropubescens.
A. Bolanderi.
A. eremiticus.

PLATE XIV.

A. arrectus var.
A. reventus and the var. conjunctus.
A. eremiticus var. Spencianus.
The form Malheurensis.

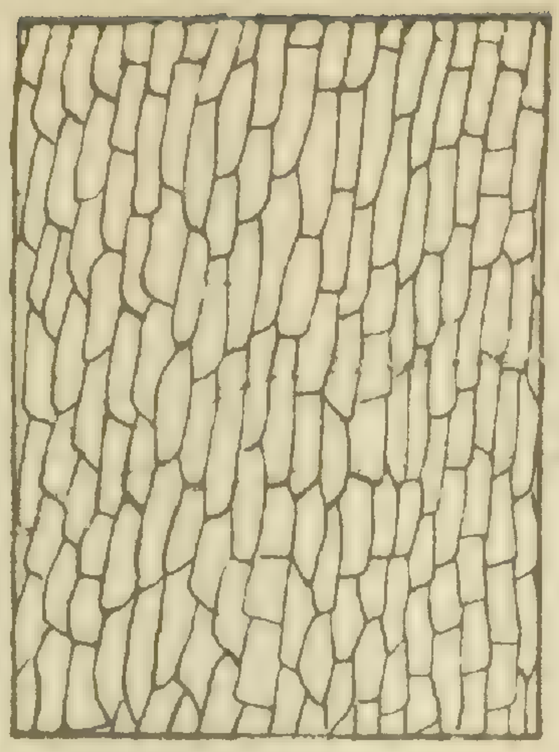
PLATE XV.

A. Francisquitensis and the var. Lagunensis.
A. atratus and the var. phyllophorus.
A. argophyllus and the hybrid with Utahensis and the var. castanæformis.

PLATE XVI.

Bœrhavia intermedia.
B. ramulosa.

2. A. validum



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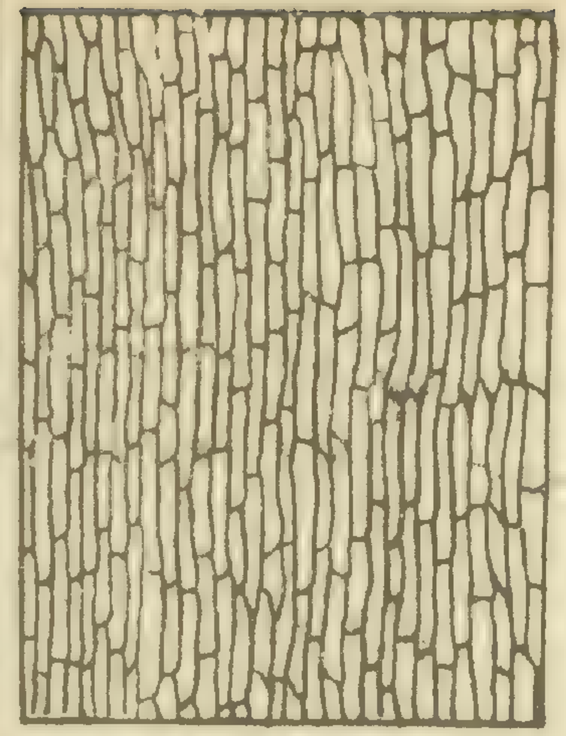
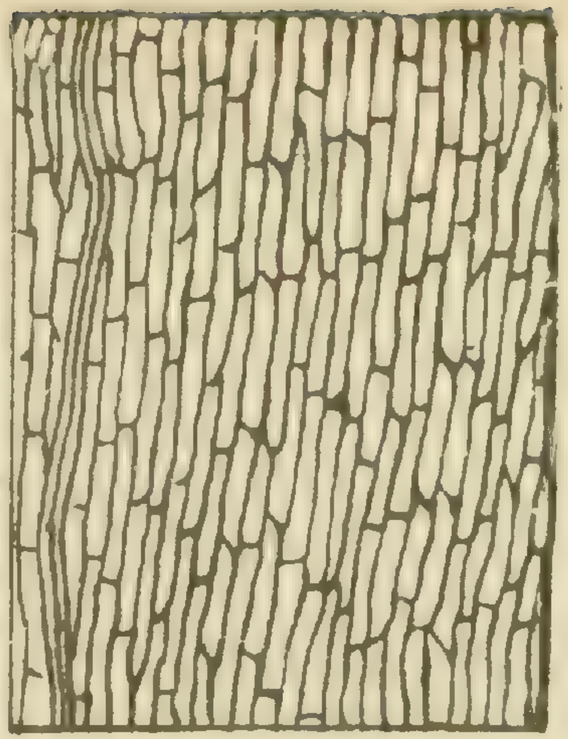
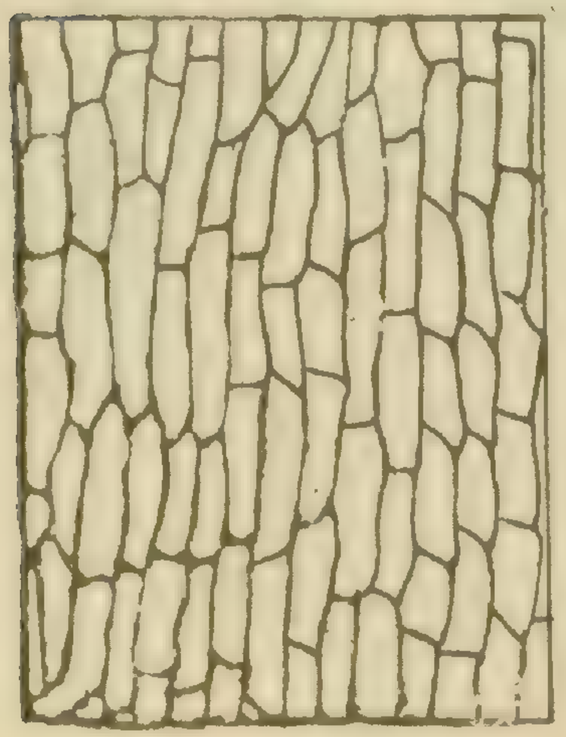


3 A. brevistylum



5 A. cernuum



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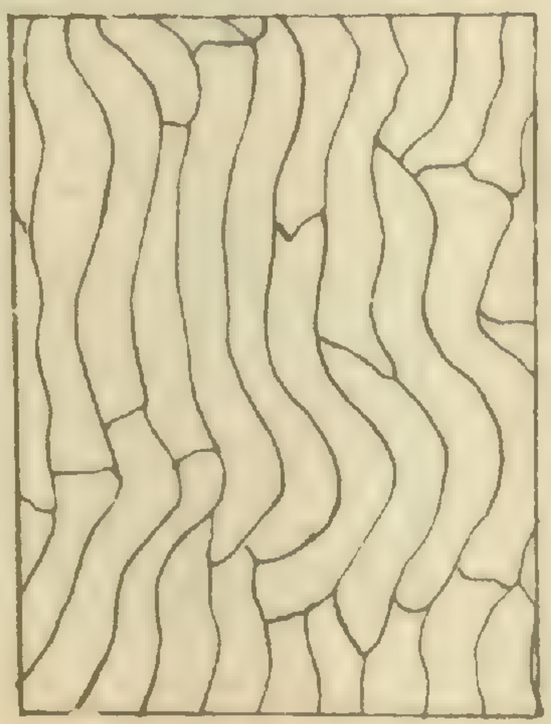
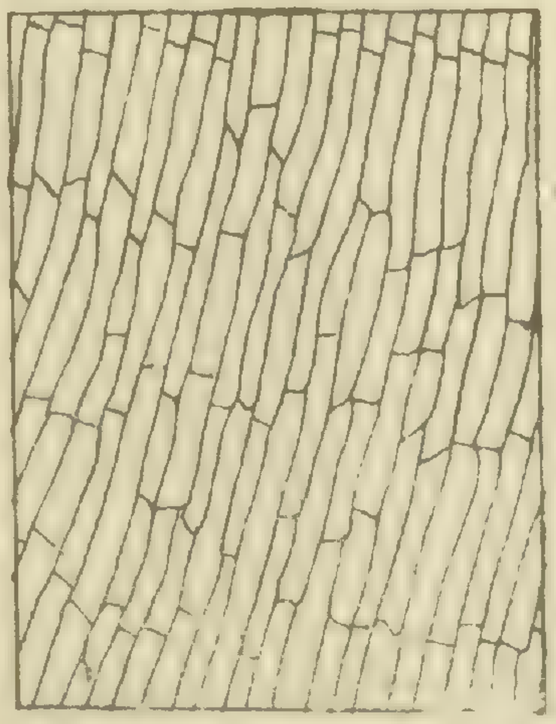
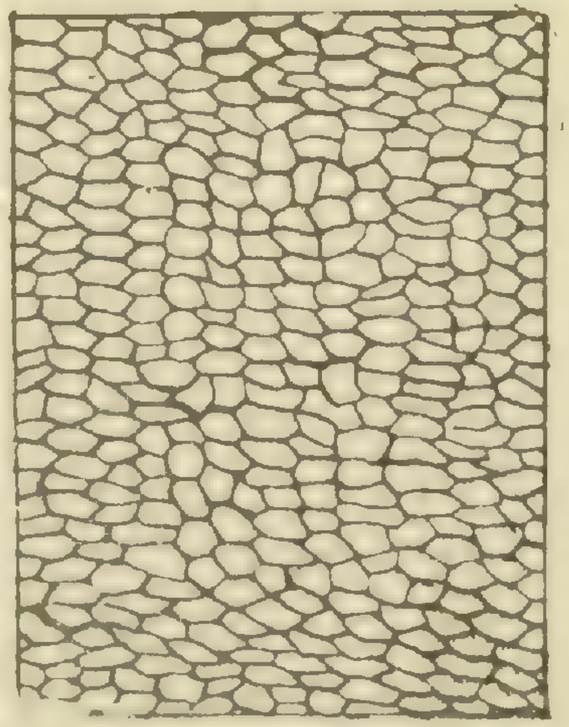


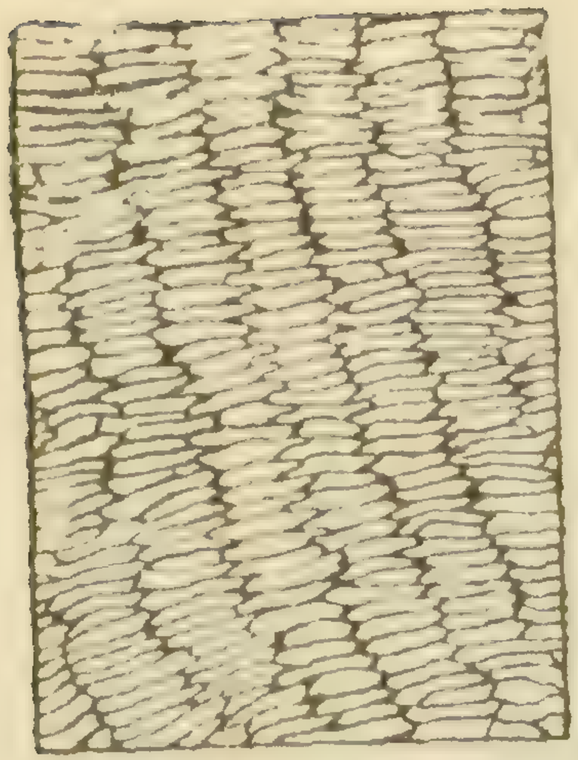
6 A. haematochiton



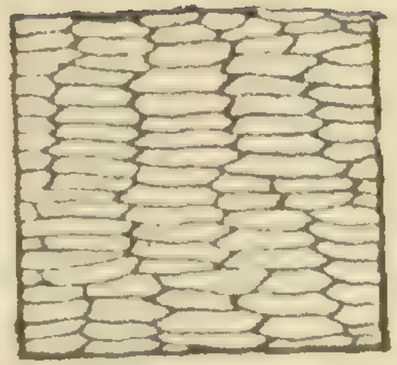
6



7 A. platycaulon

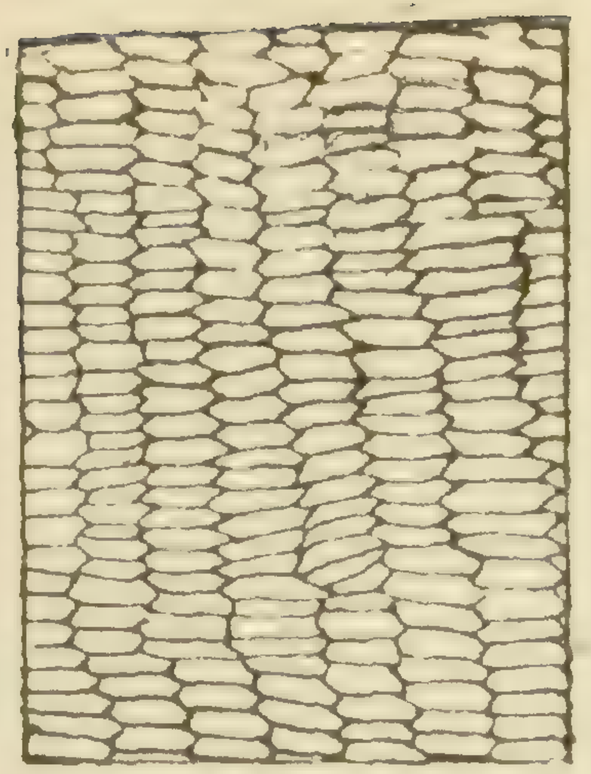


8 A. anceps

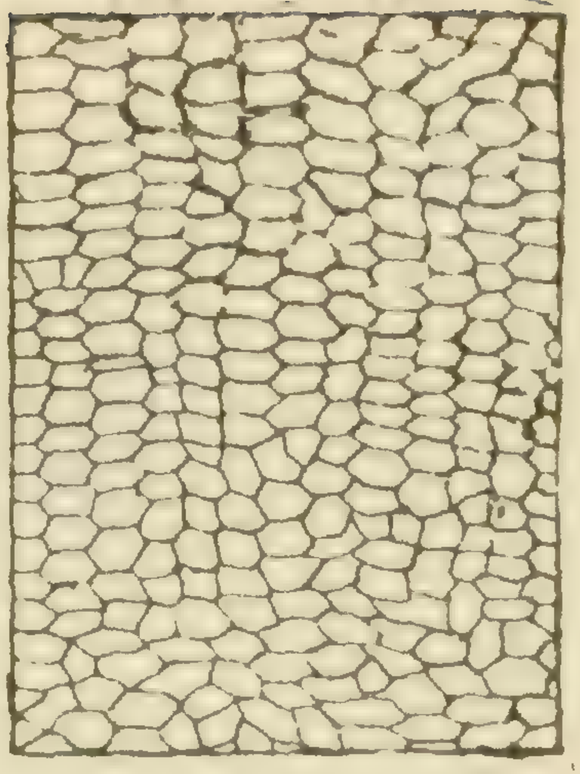


Alter Watson × 30

9

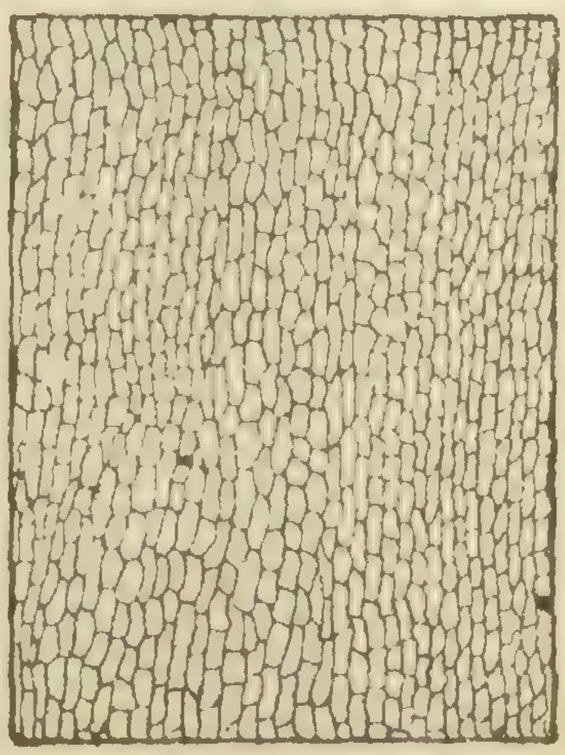


9 Var



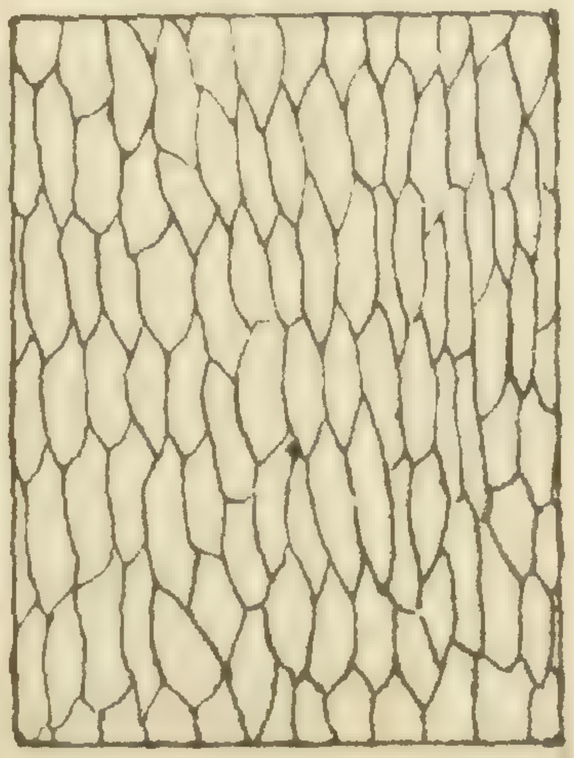
9 Near Base

A. plerianthum

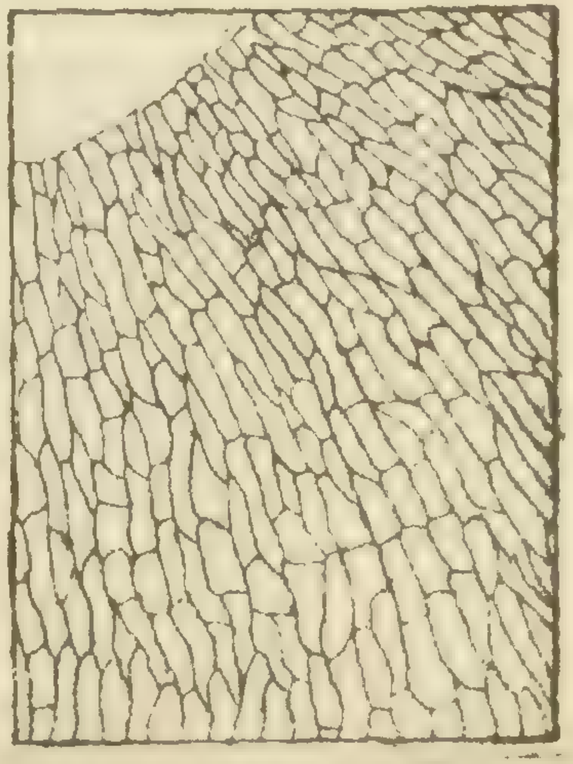


15 A. parvum

Outer Membrane

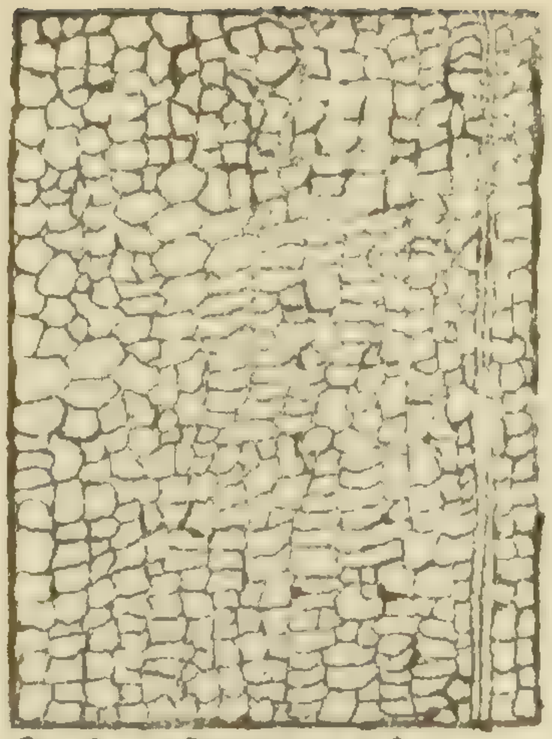


16. Var Brucae

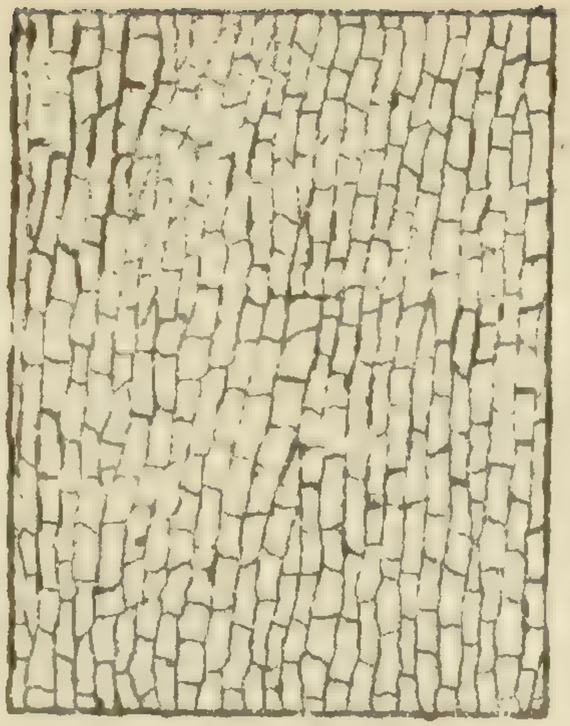


Near Tip

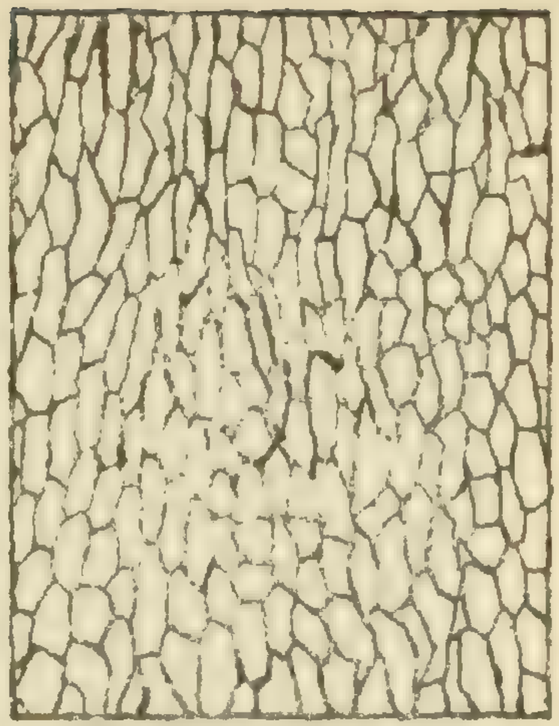
4 A. Plummera



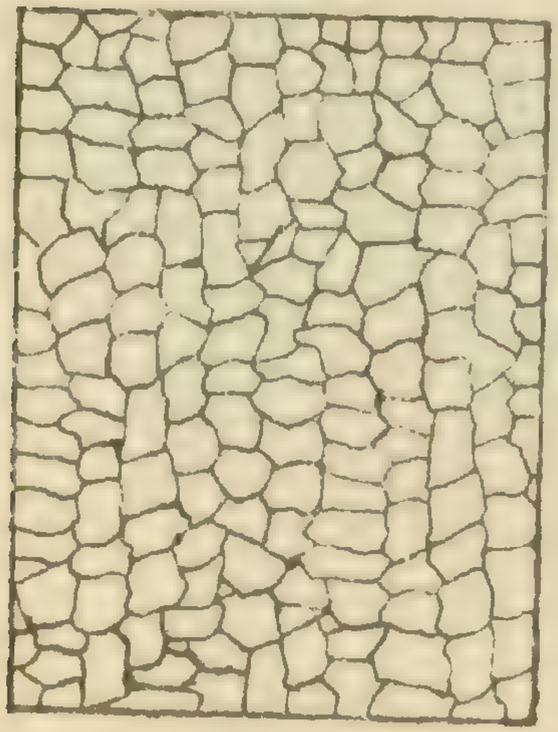
7 A. platycaule
Outer Membrane



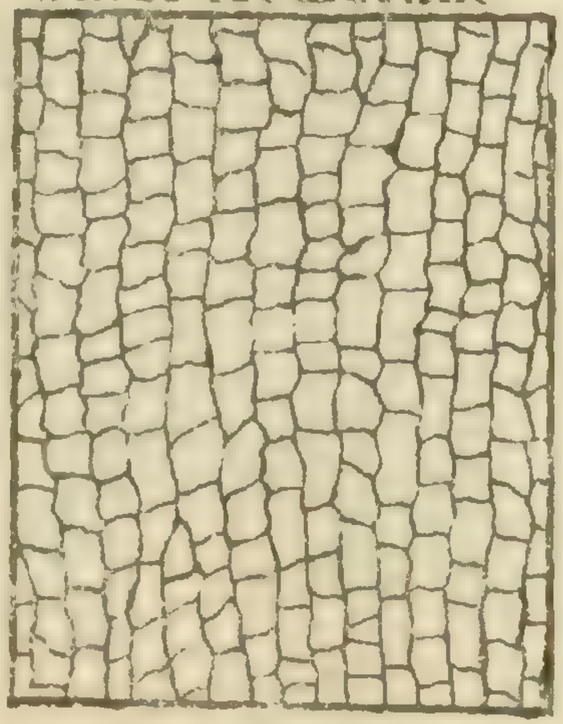
14 A. falcifolium
Outer Membrane



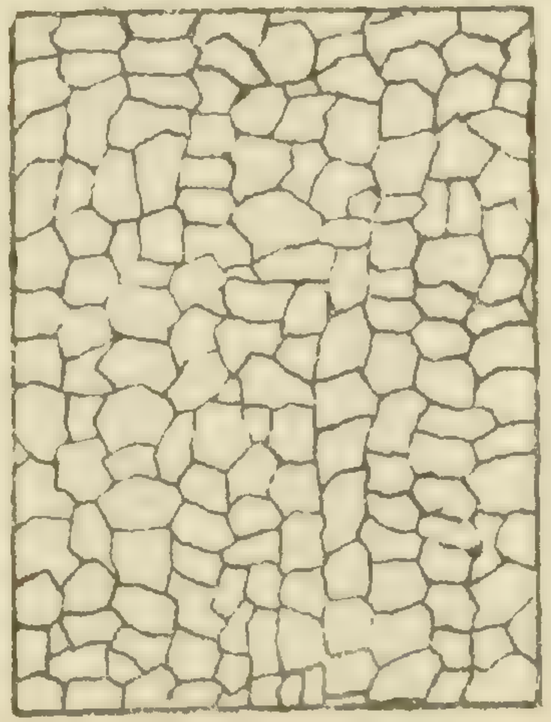
38 A. obtusum
Near Base



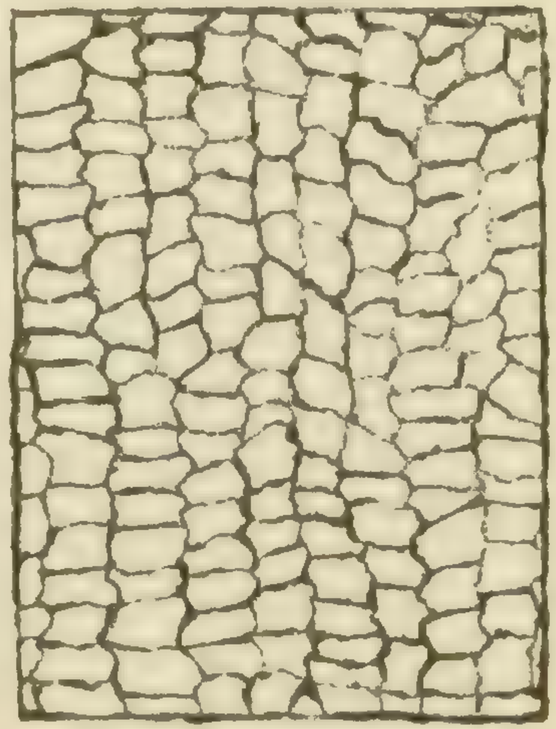
38 A. obtusum



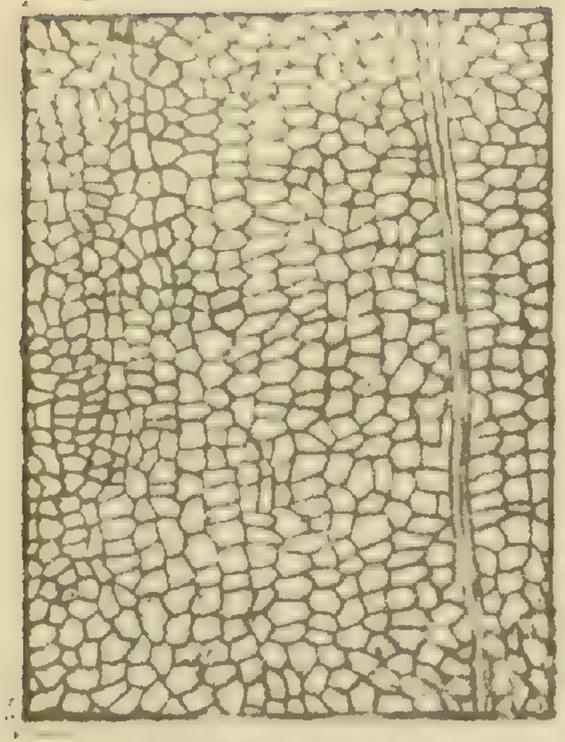
38 A. obtusum



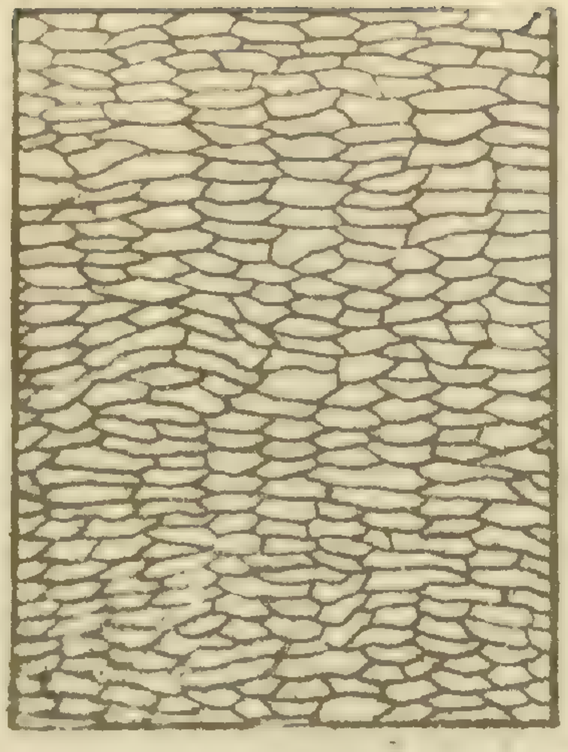
38 A. obtusum



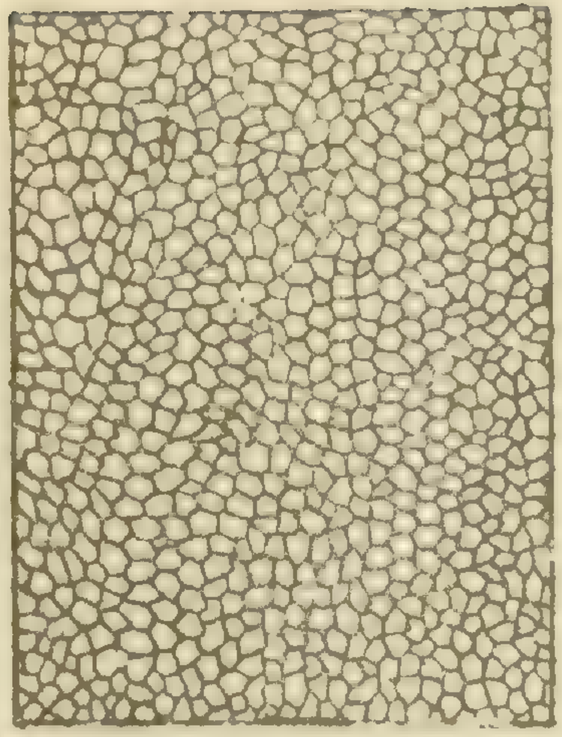
38 A. obtusum



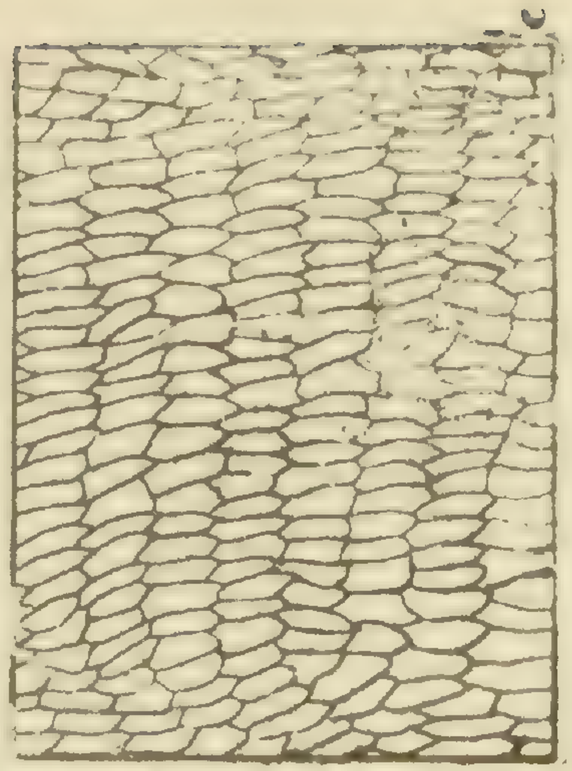
16 Outer Membrane.



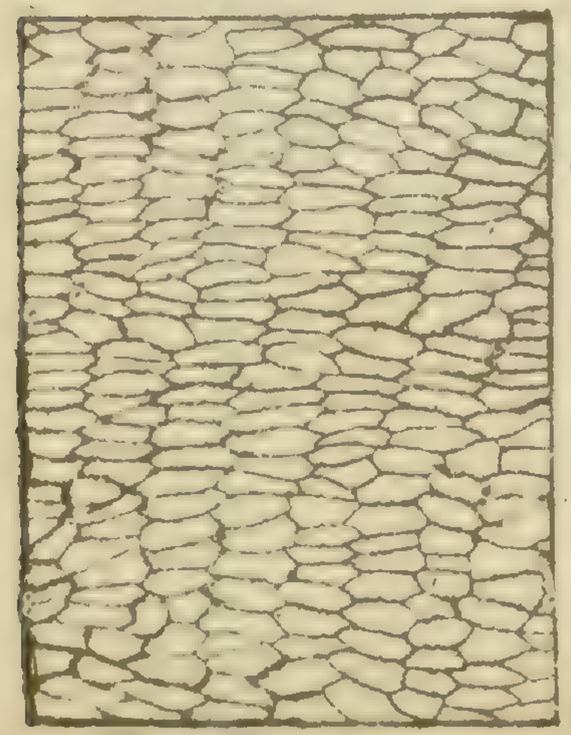
17.



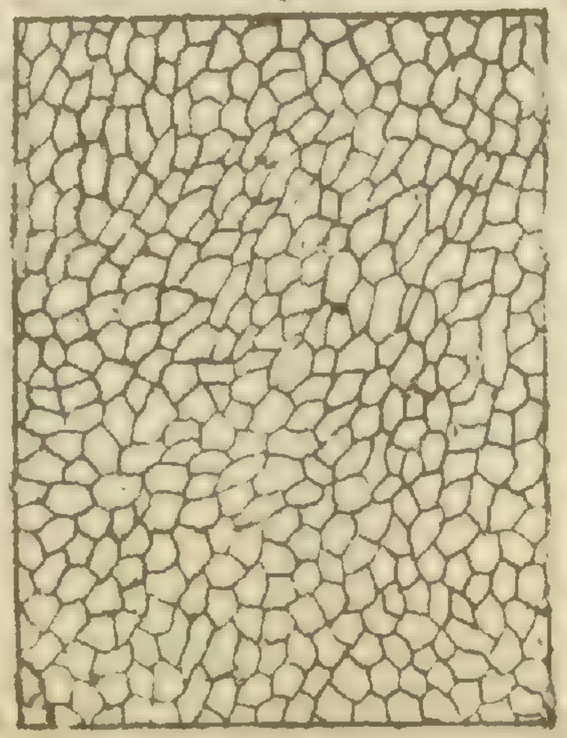
17. A. Lemmoni Near Base.



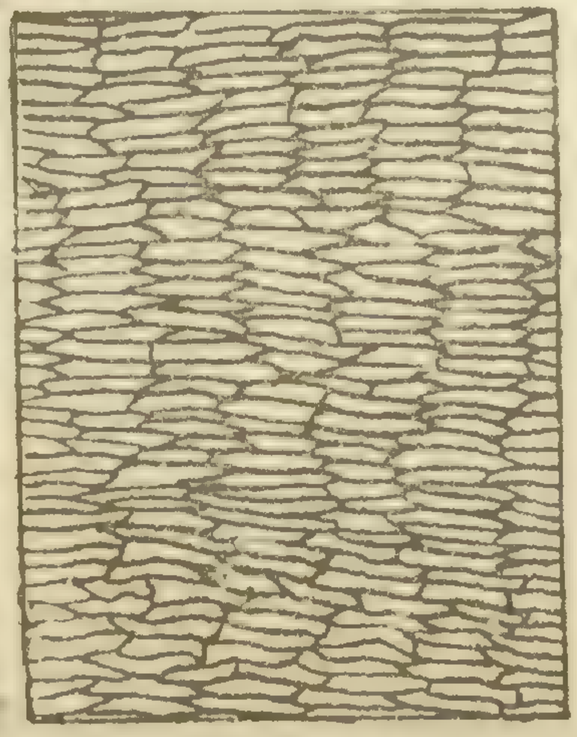
18. A. Brandegei



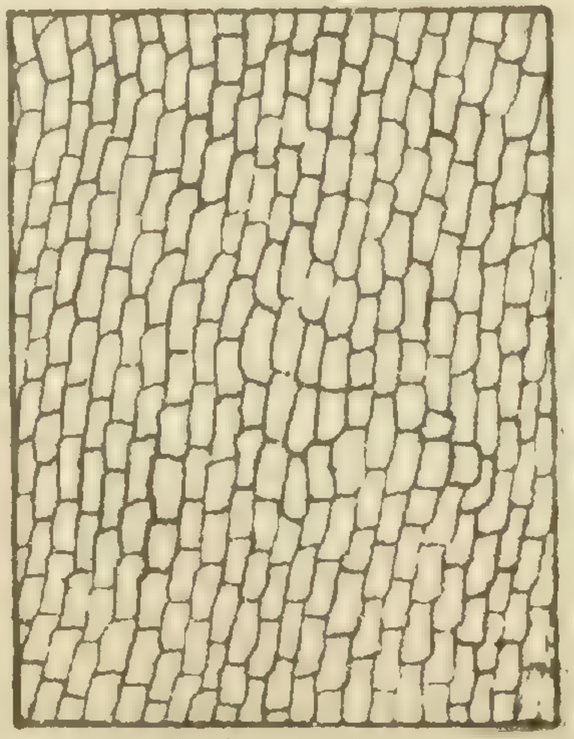
18



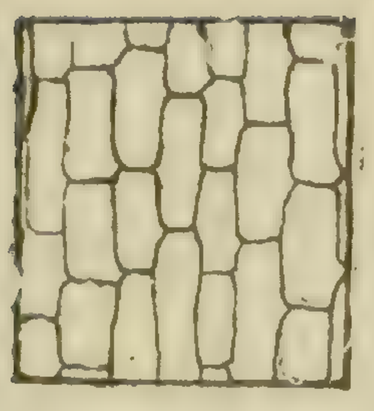
28. Near Base



A. miser



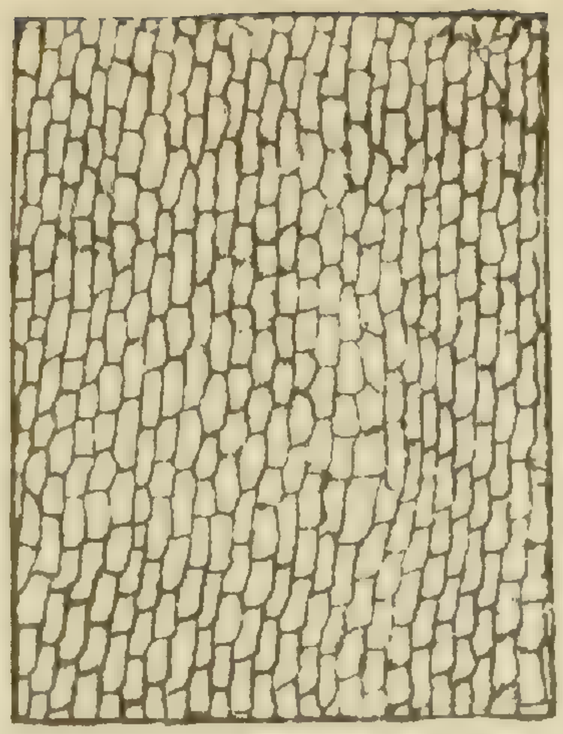
19. A. scaposum



After Watson. x 30 D.

19

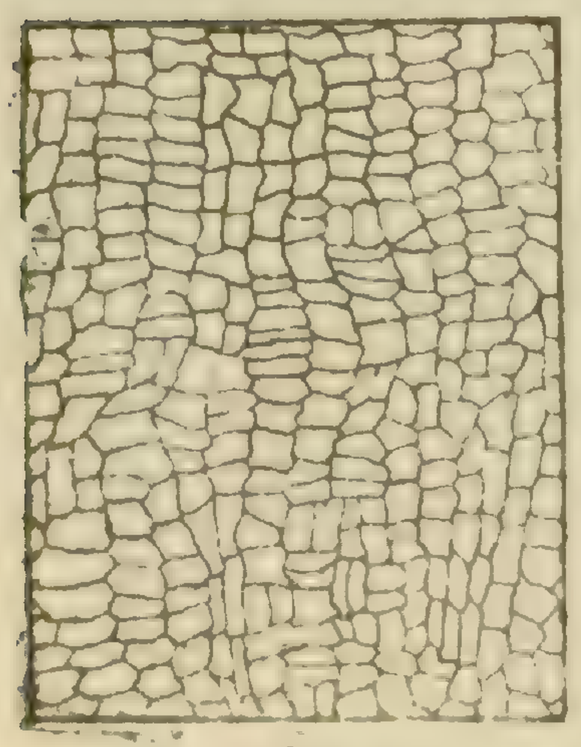
20 A. stellatum



20

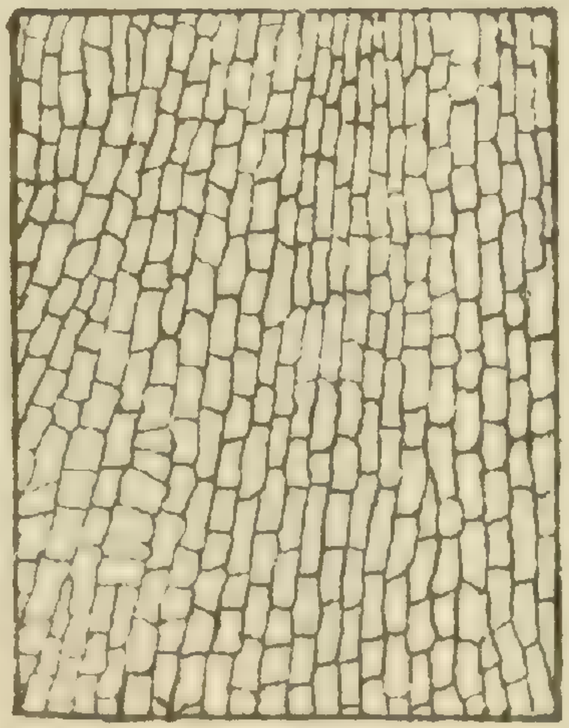
After Watson x 30 D.

21. A. Bigelovii

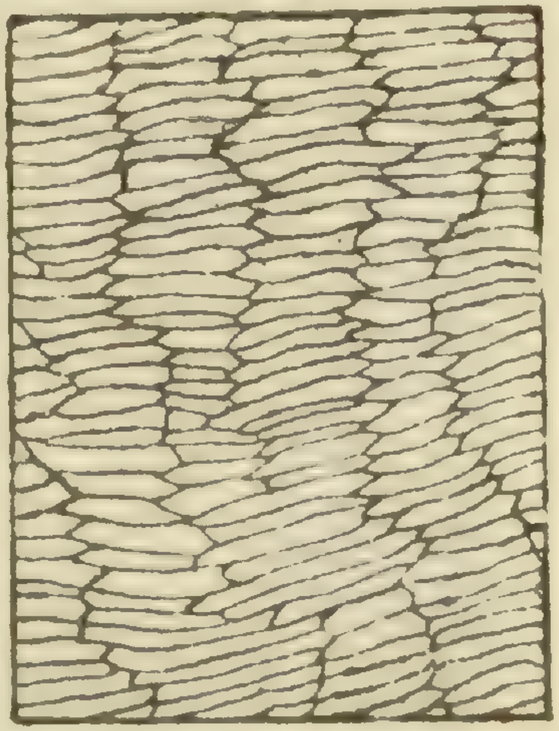


26. A. Parryi

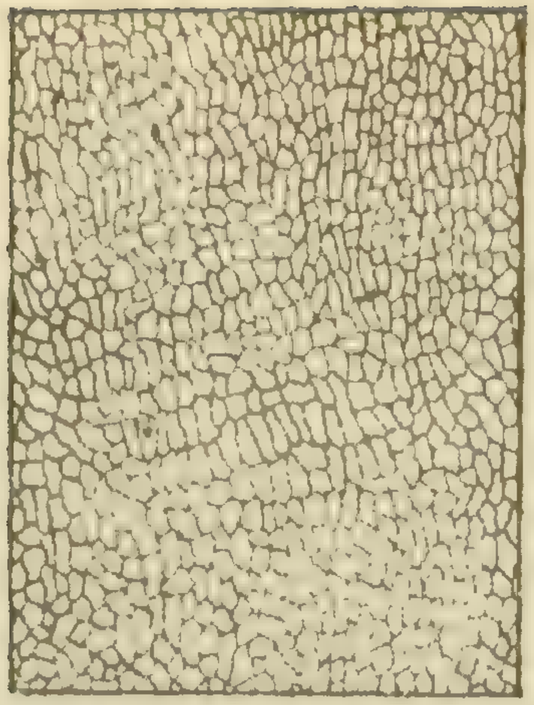
27 A. atrorubens



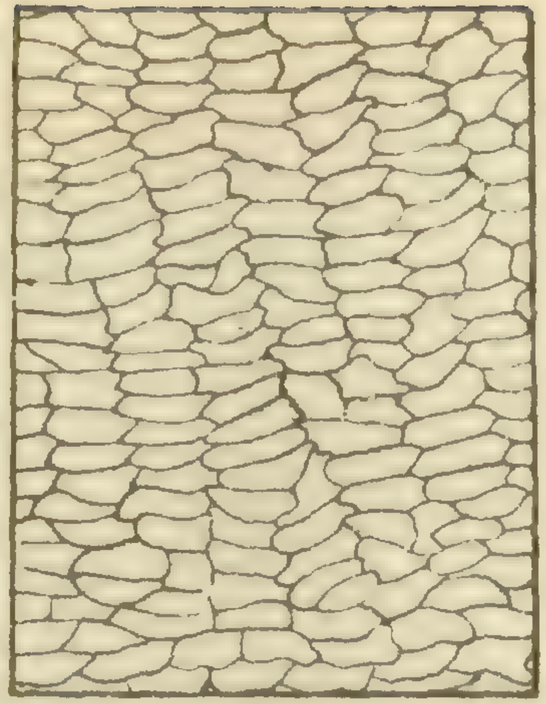
29 A. decipiens



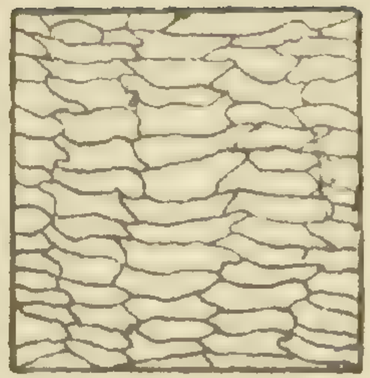
31. A. macrum



31 Outer Membrane

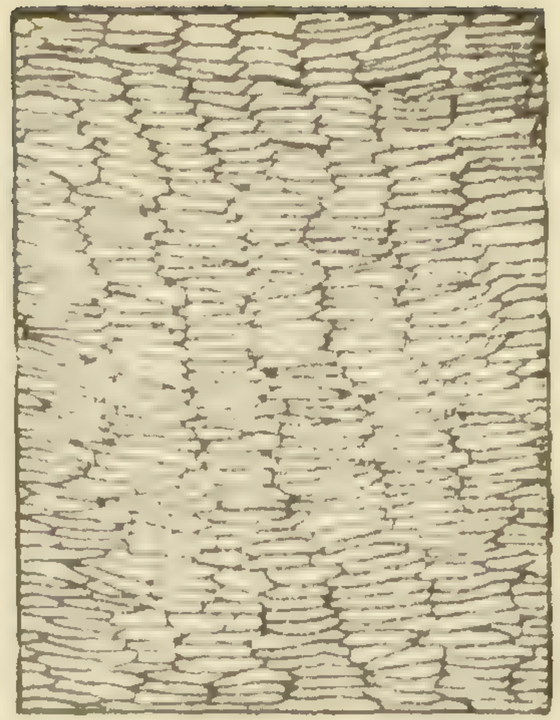


32 A. Nevii



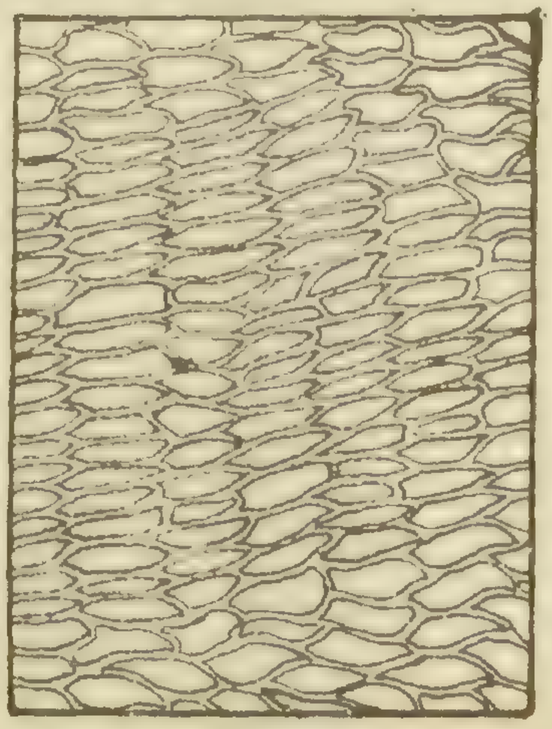
After Watson x 30 D

33 A. tribracteatum

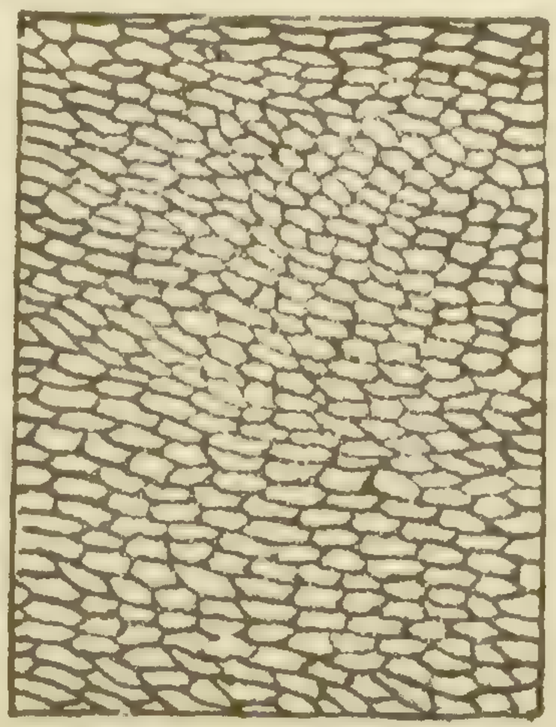


34 Var Dichtii

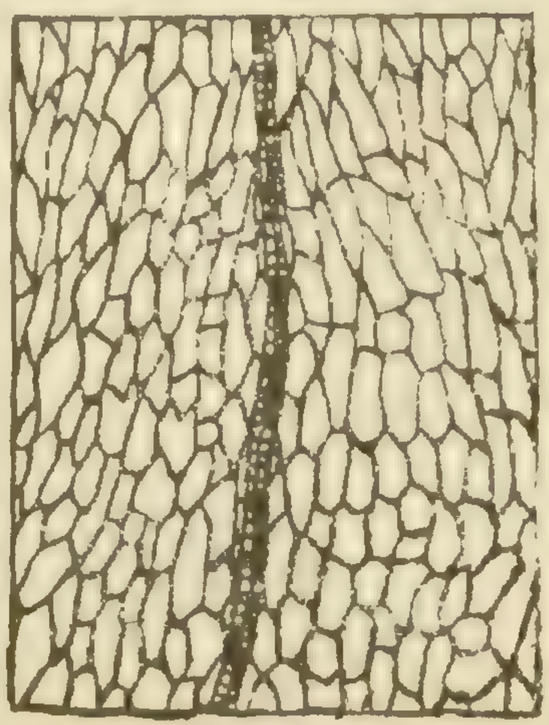
34



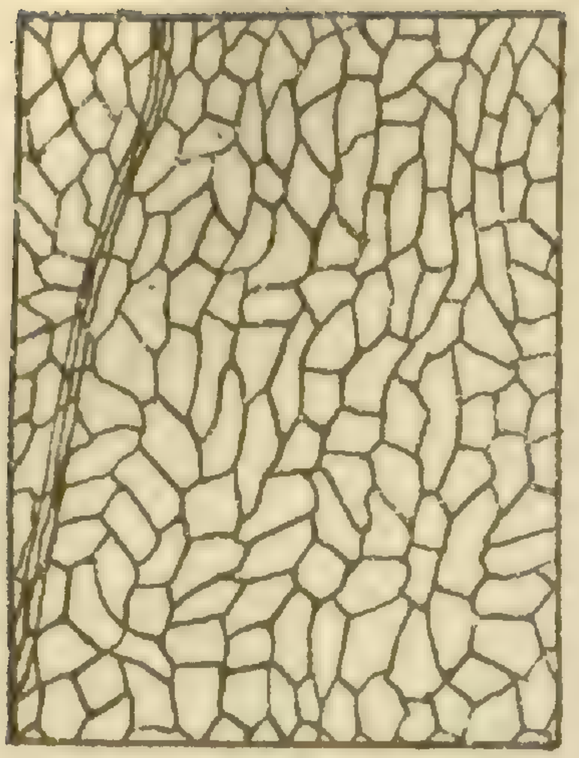
34



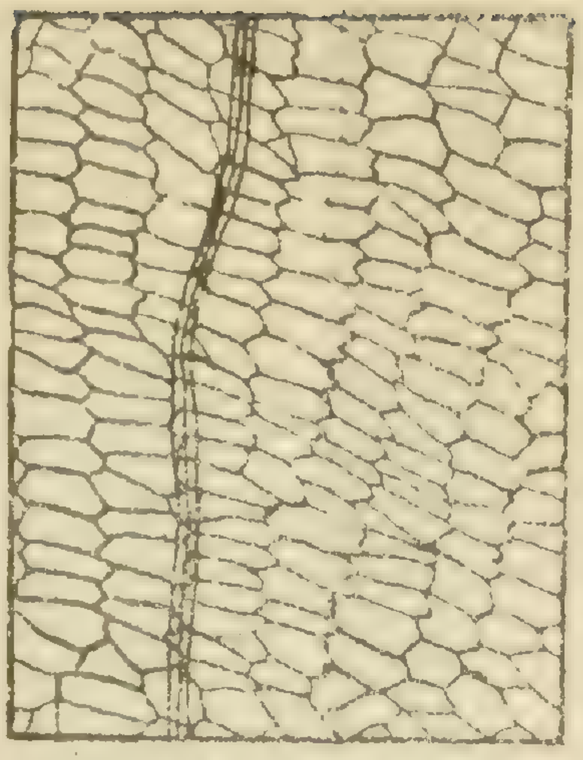
34 Near Base.



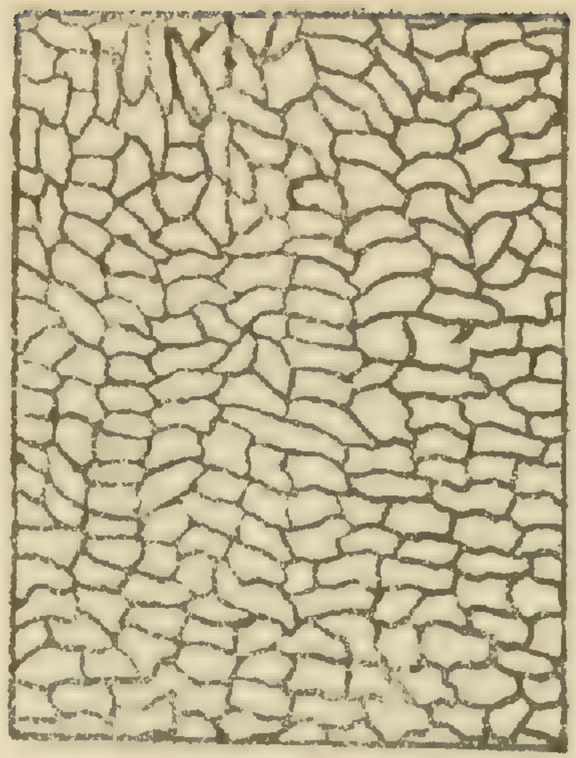
33 Near Base



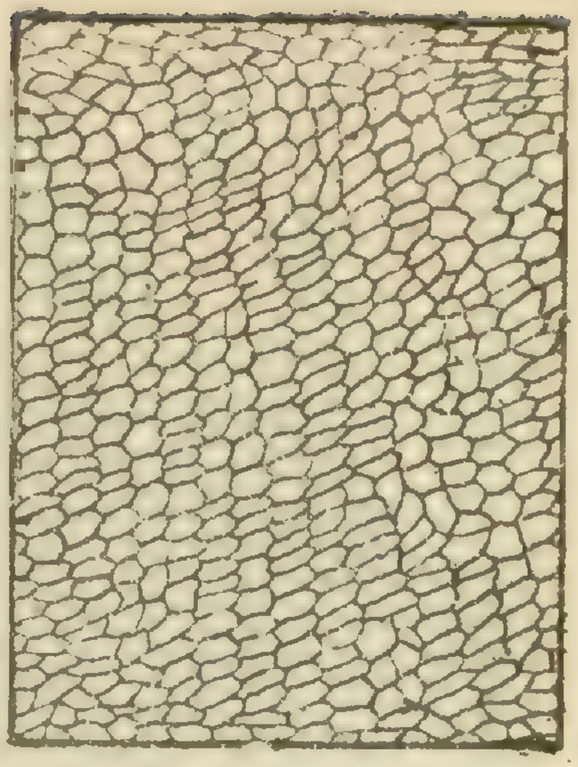
35 Near Base.



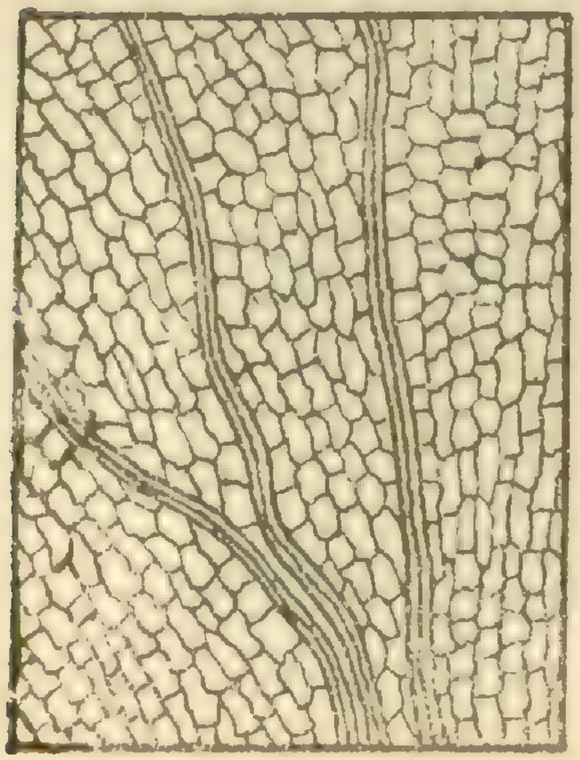
35 A. ambiguum



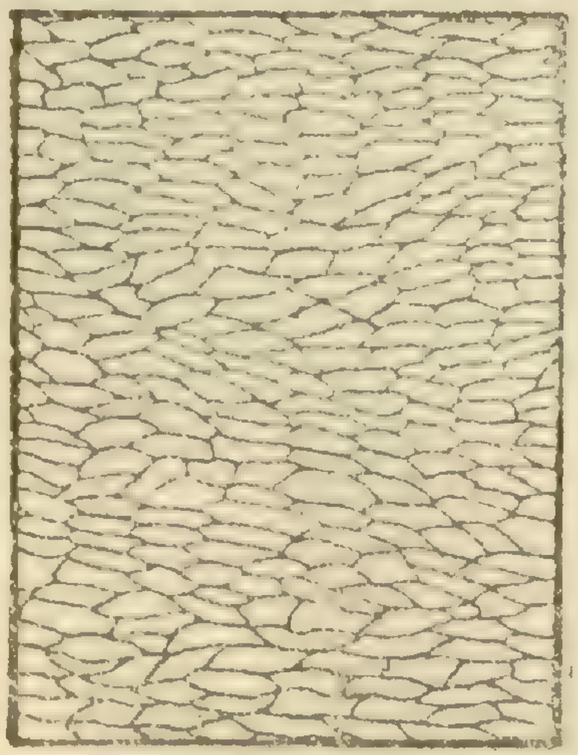
36



36. A. minimum



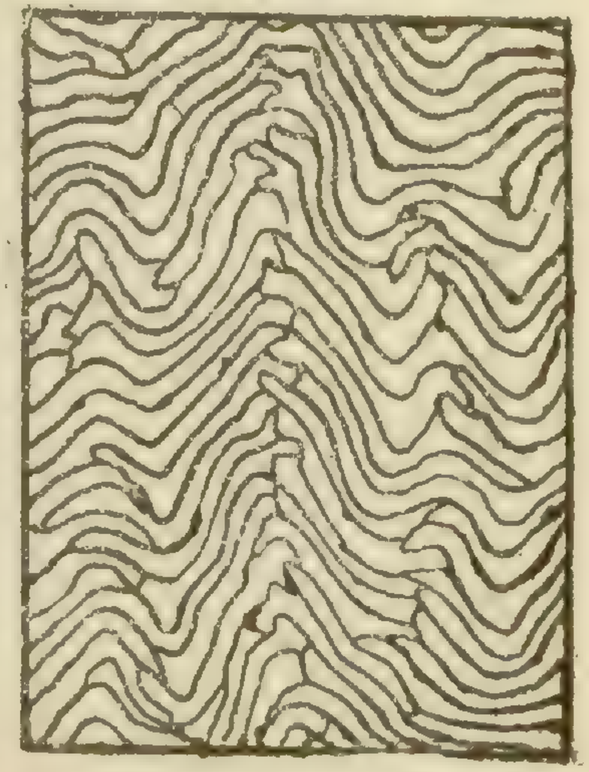
35 Near Base.



32

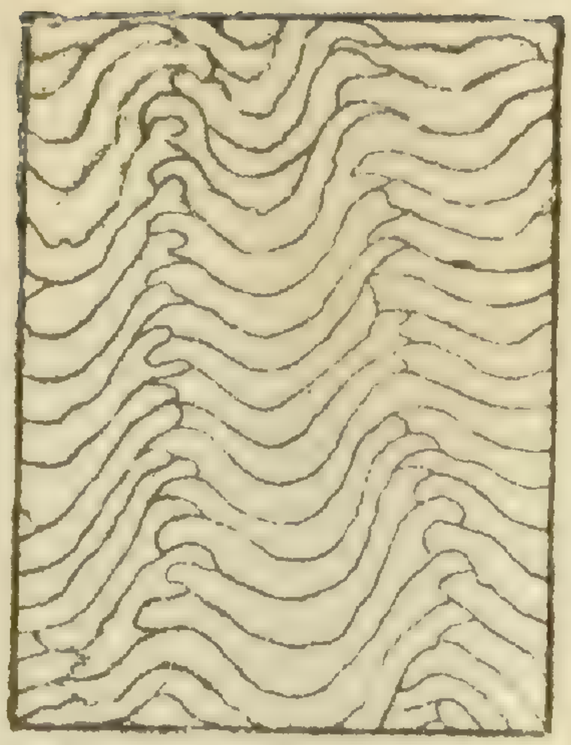
After Watson x 30 D.

10. A. serratum



10

After Watson x 30 D



41 A attenuifolium

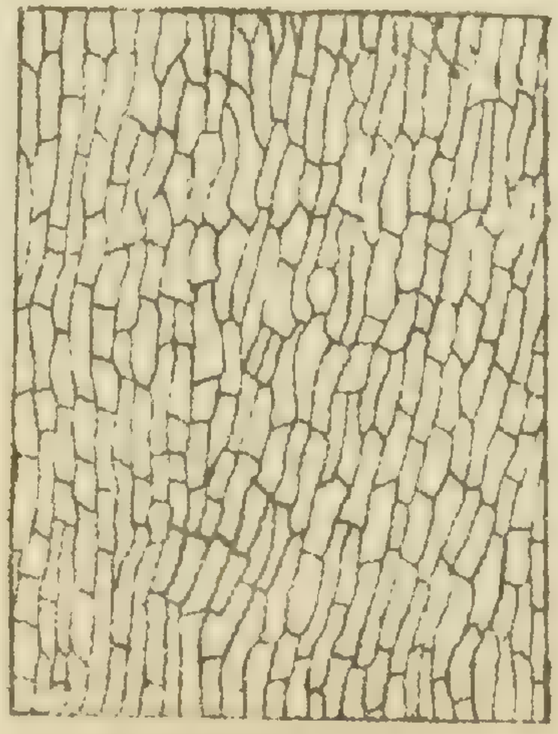
41

41

41

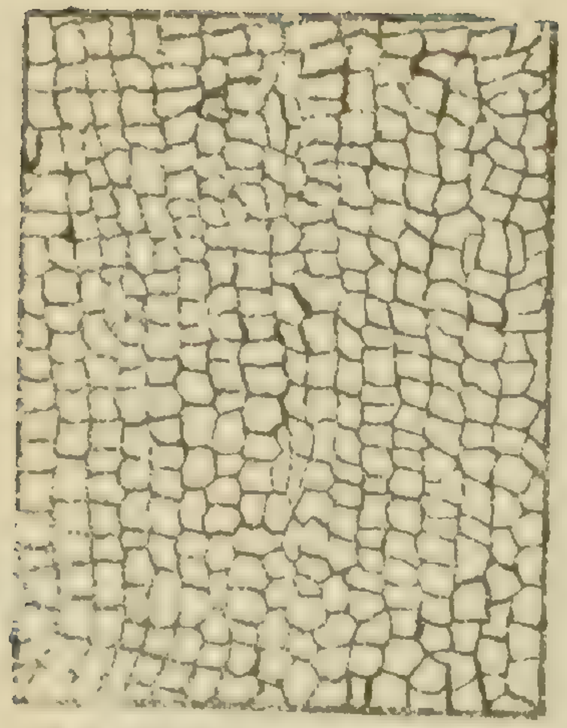
After Watson x 30 D.

41



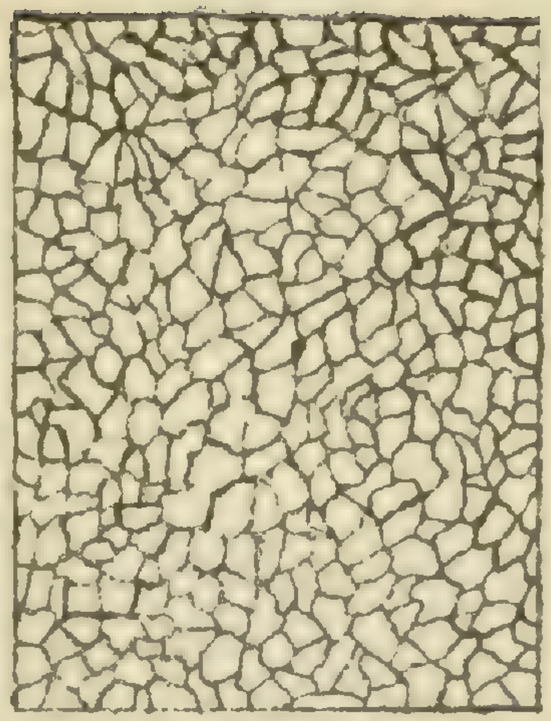
41 Outer Membrane.

41



43 A. Holanderi
Outer Membrane

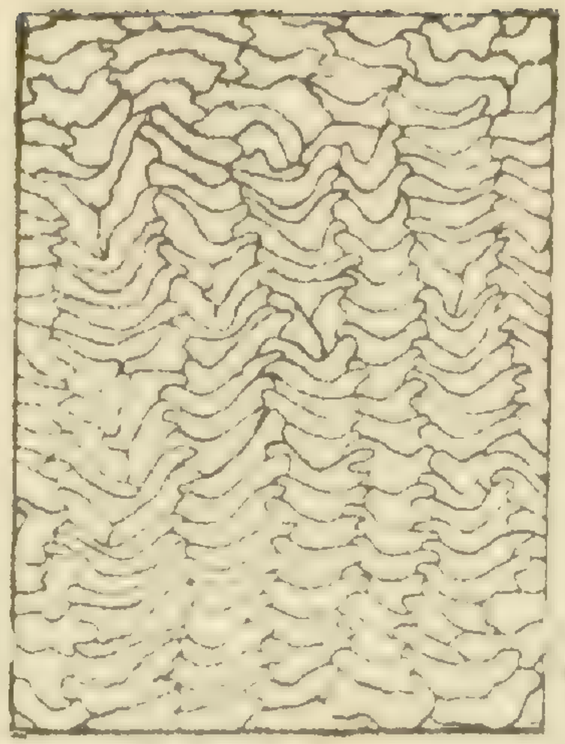
A. unifolium



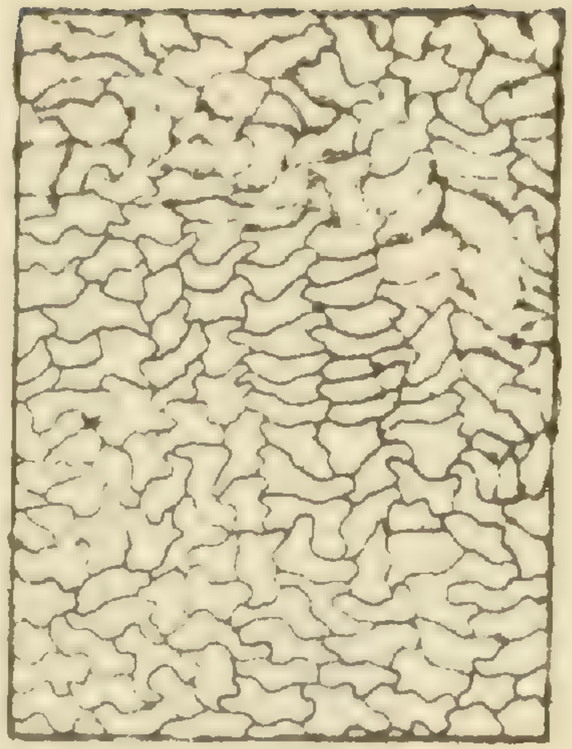
A. unifolium
Outer Membrane

42

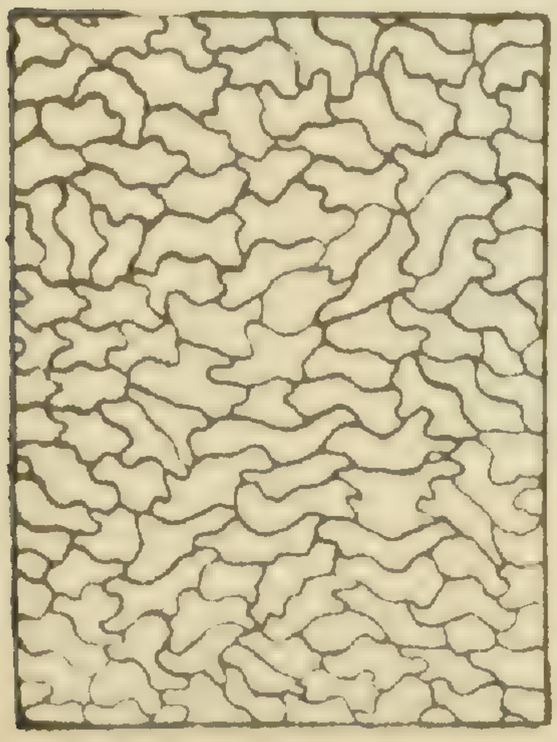
42 A. hyalinum



42



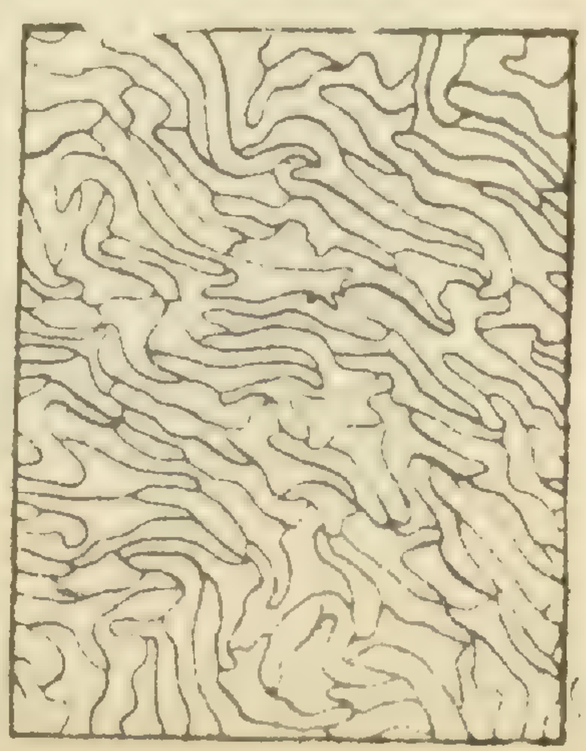
42



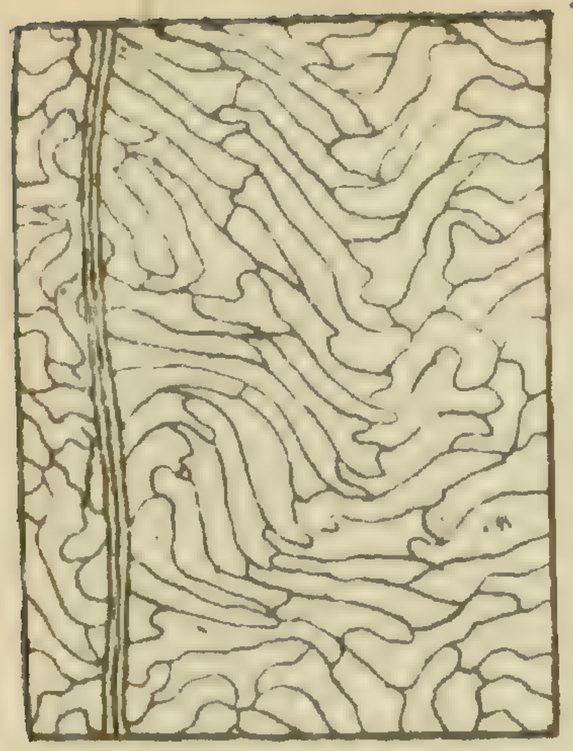
43

43 N. [illegible]

43 A. Bolanderi

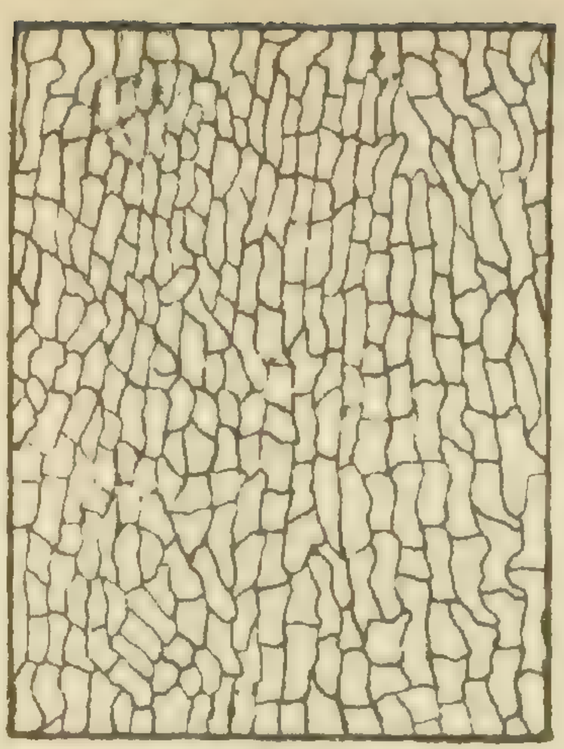


43

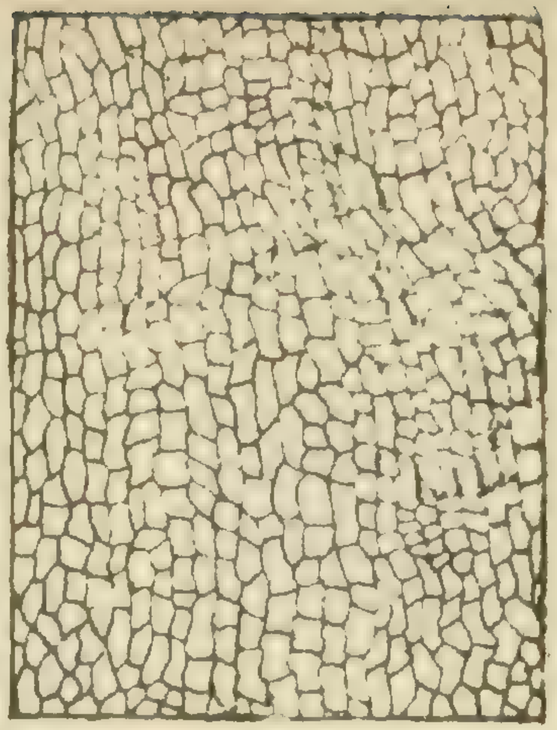


44 A. peninsulare

44

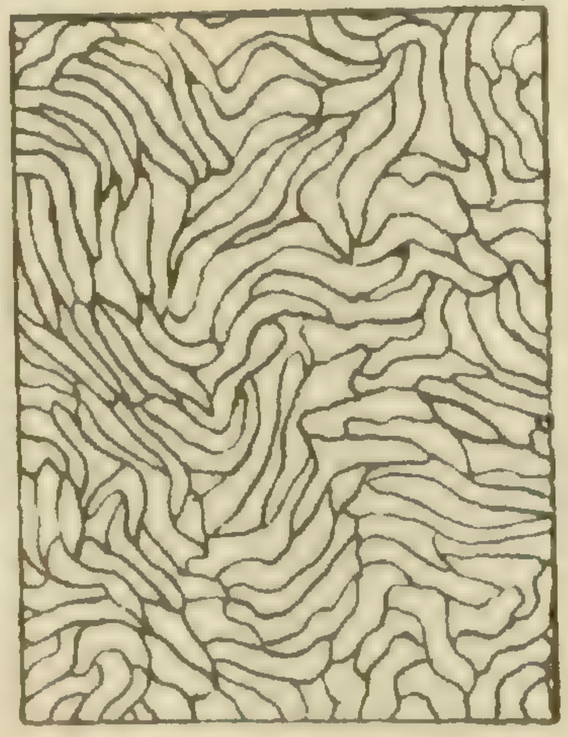


44 Near Tip

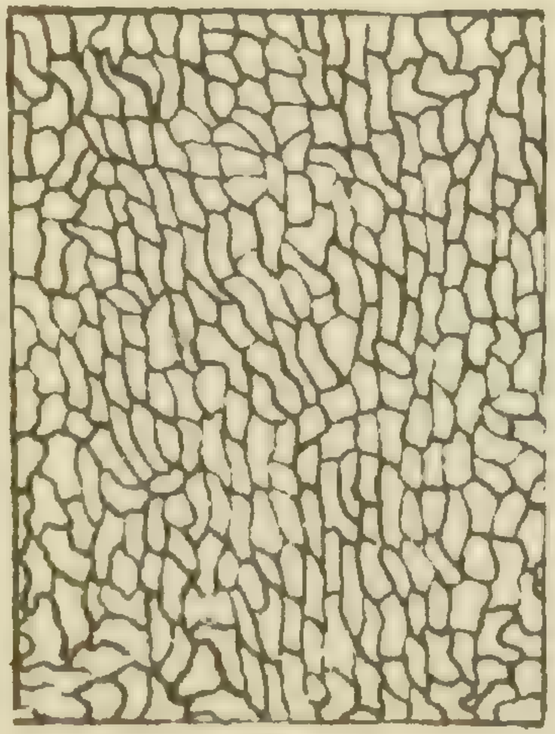


44 Outer Membrane

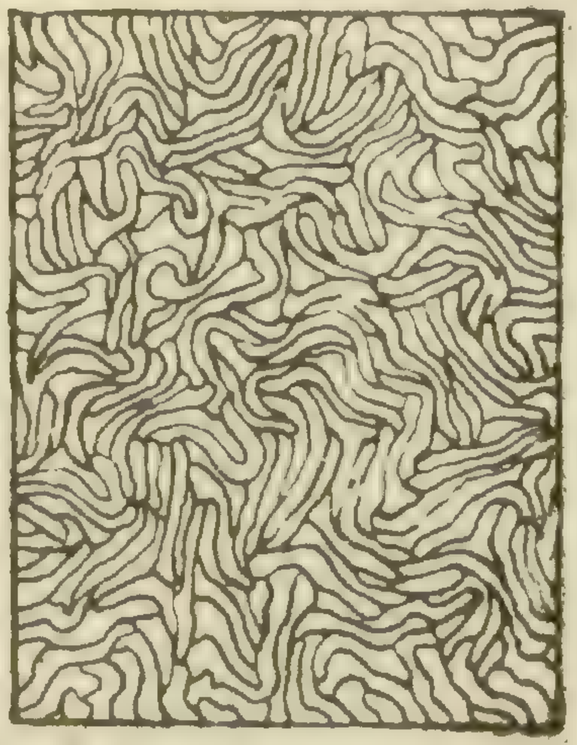
45



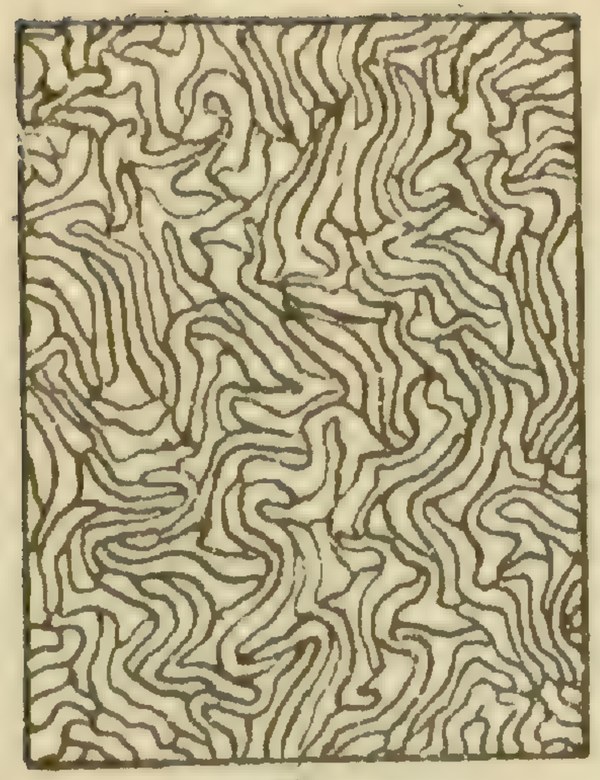
45. A. madidum



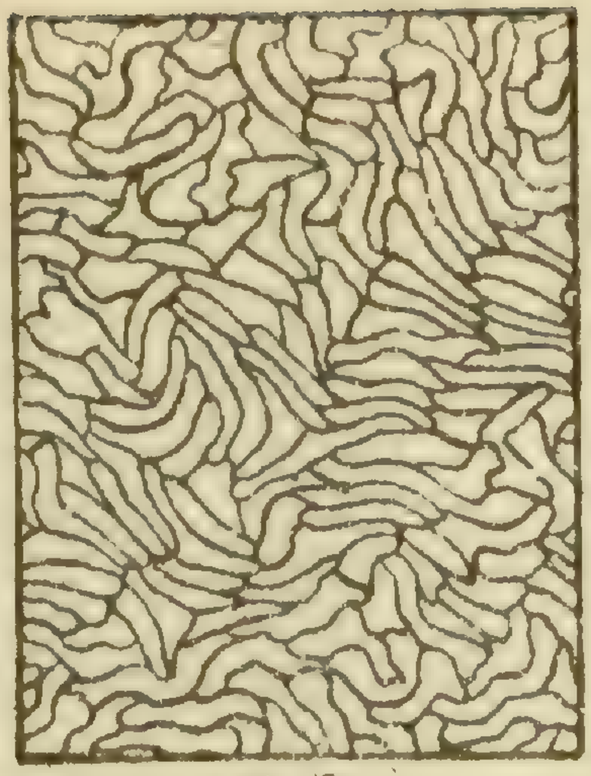
45 Near Tip.



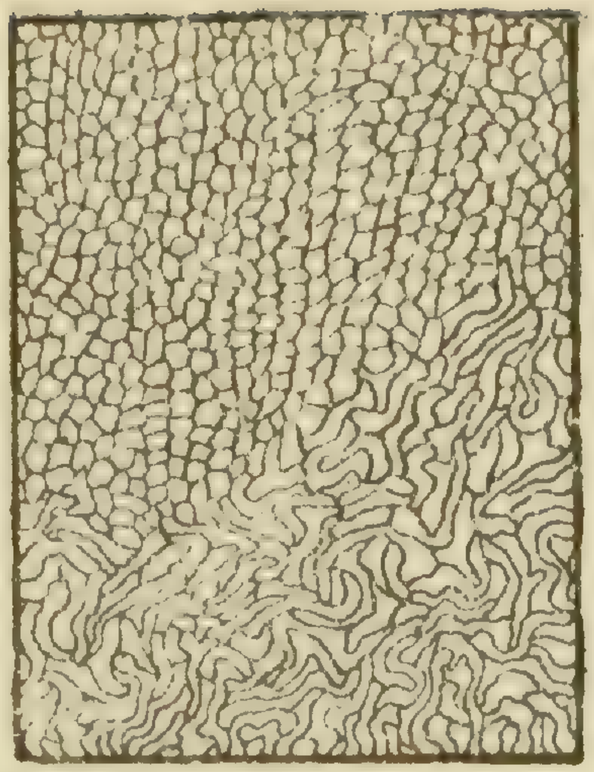
46 A. collinum



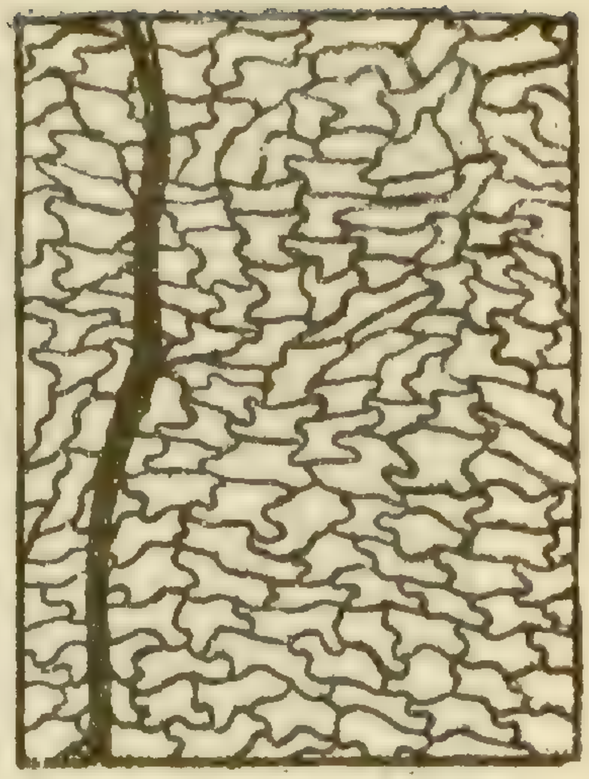
46



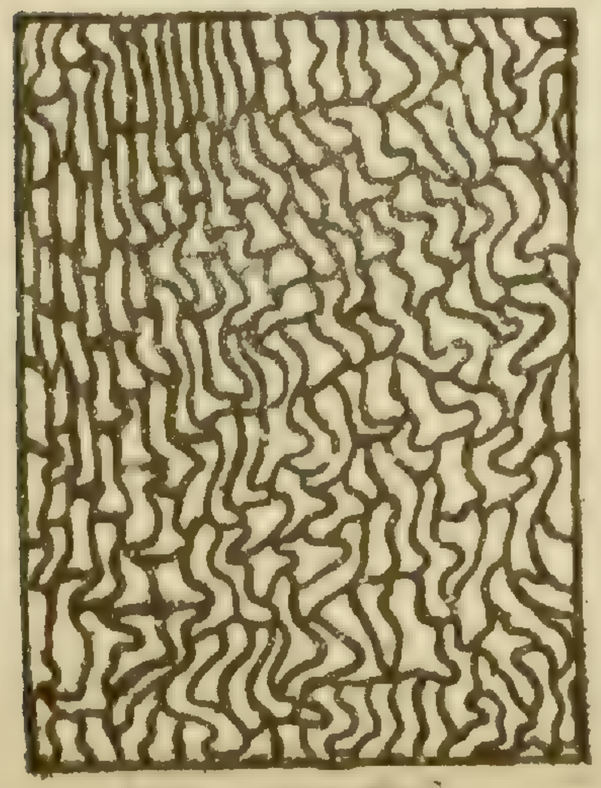
46 ?



46 + Outer Membrane.



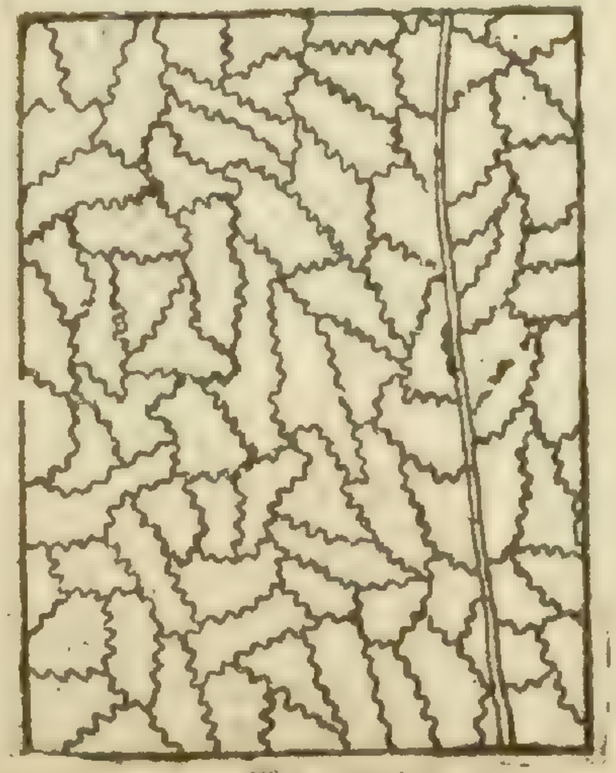
47. A. Nevadense



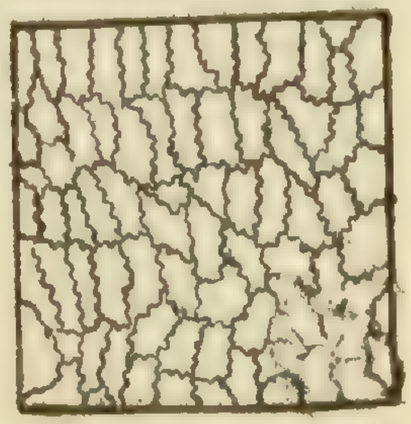
47 Near Tiu.

After Watson x 30 D.

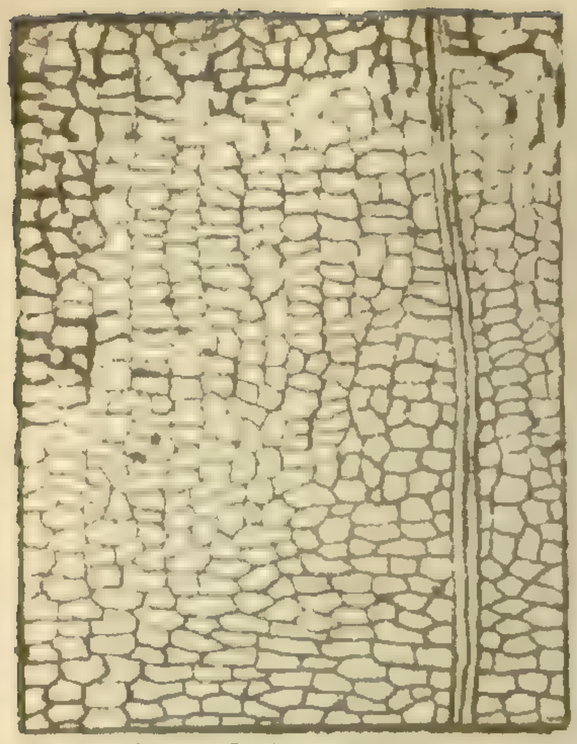
43



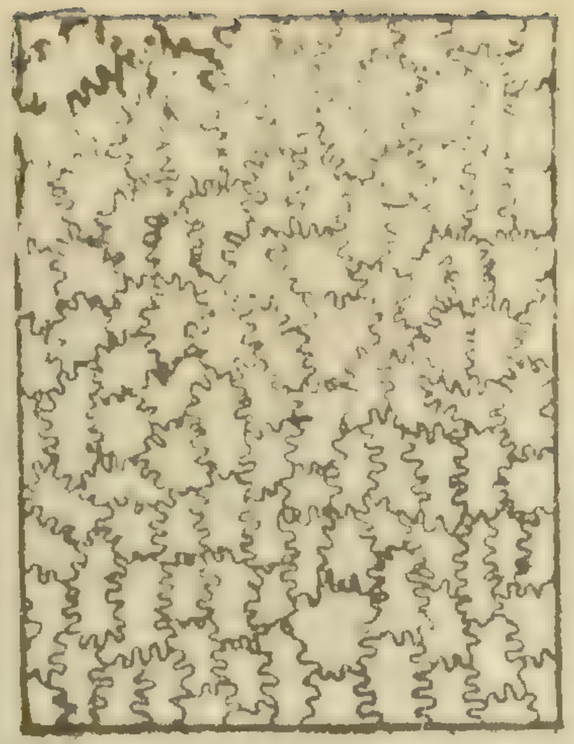
48. A. Palmeri



Watson x 30 D

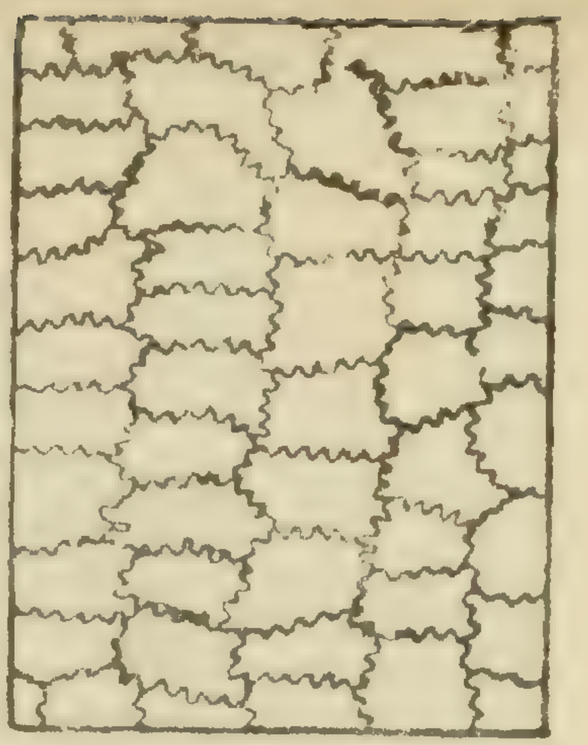


38 A. obtusum
Outer Membrane

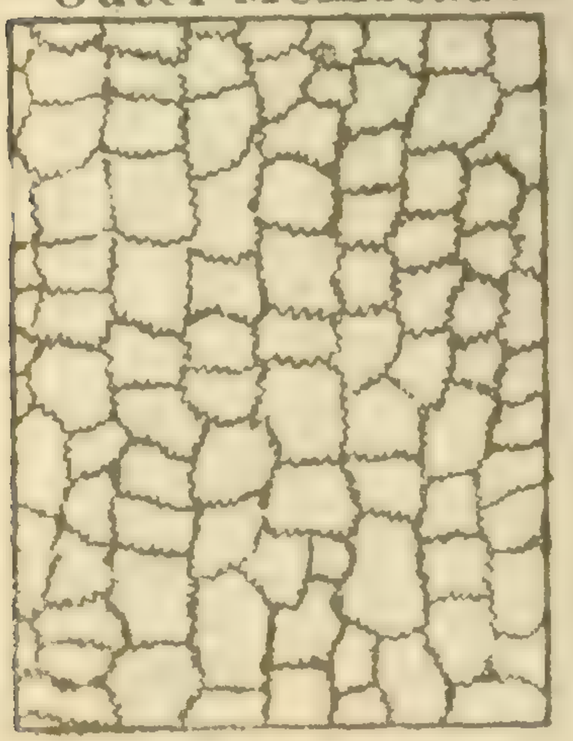


24 A. campanulatum

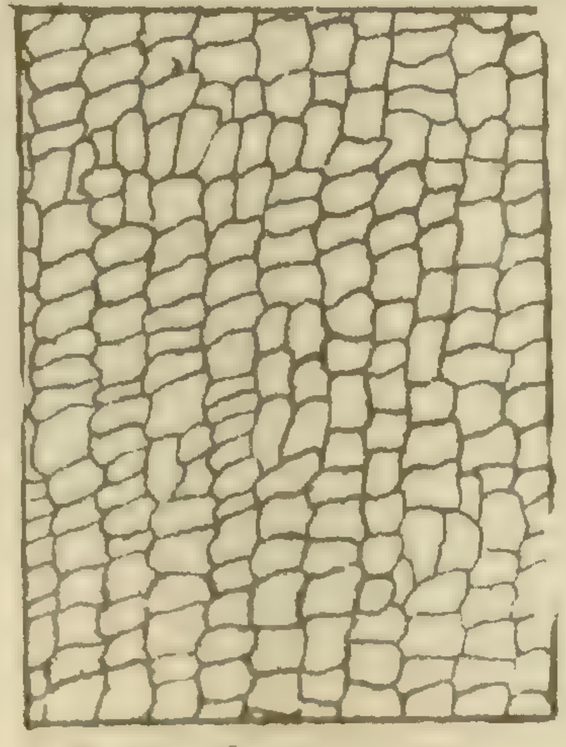
24 Outer Membrane



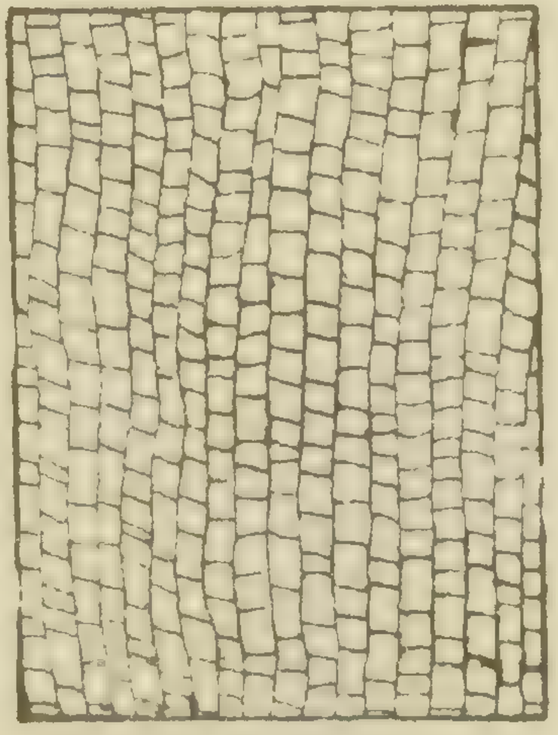
49 A. lacunosu



49 A. lacunosum

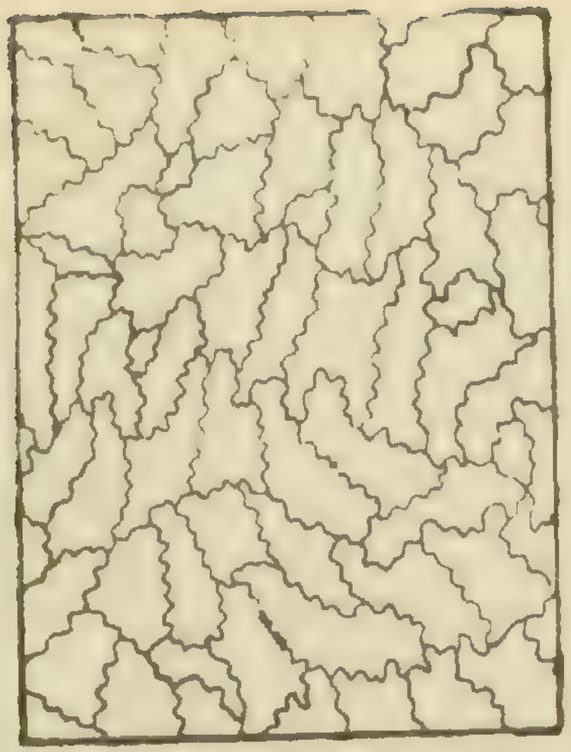


49 A. lacunosum
Outer Membrane

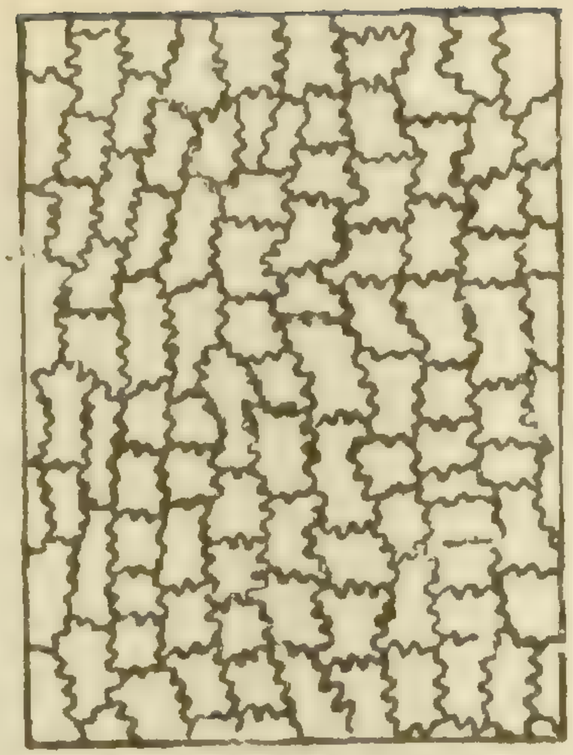


51 A. Sandoruli
Outer Membrane

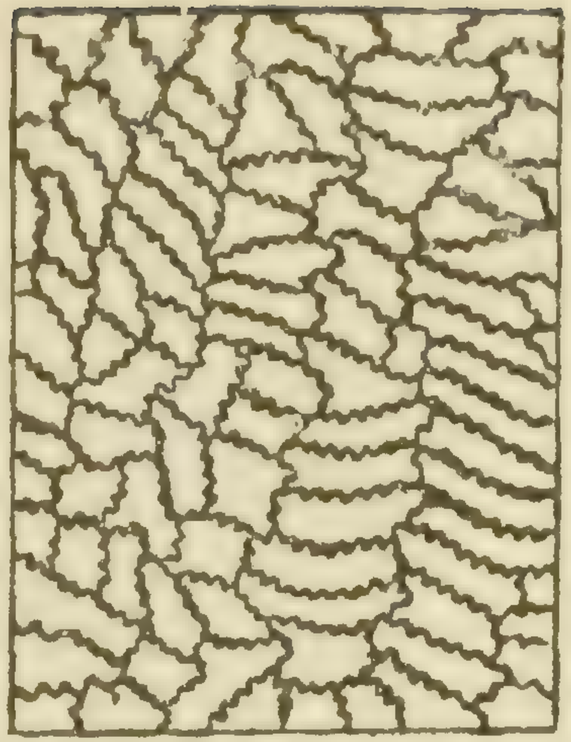
43 A. Bolanderi



48 Near Base.



48



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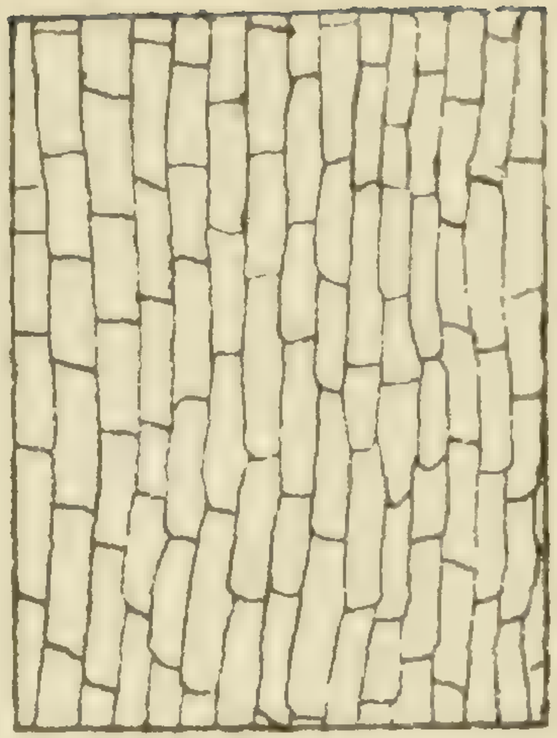
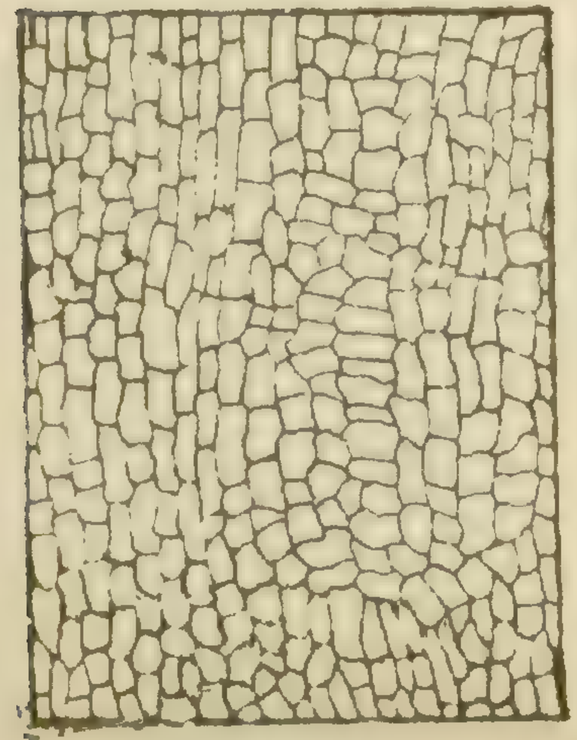
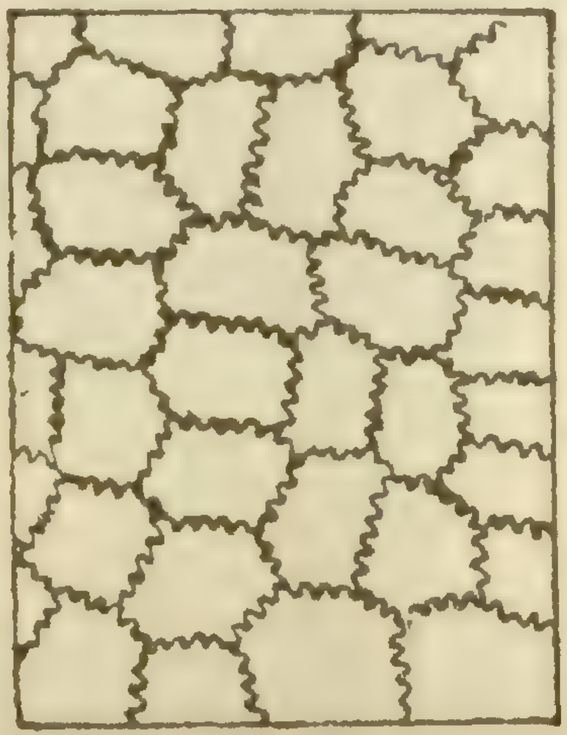


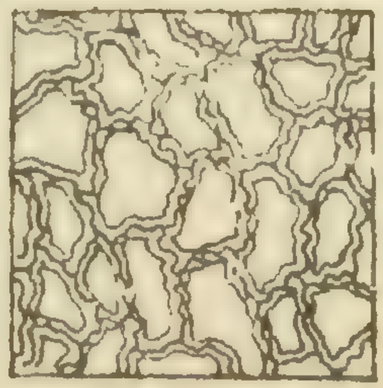
49. A. lacunosum



49

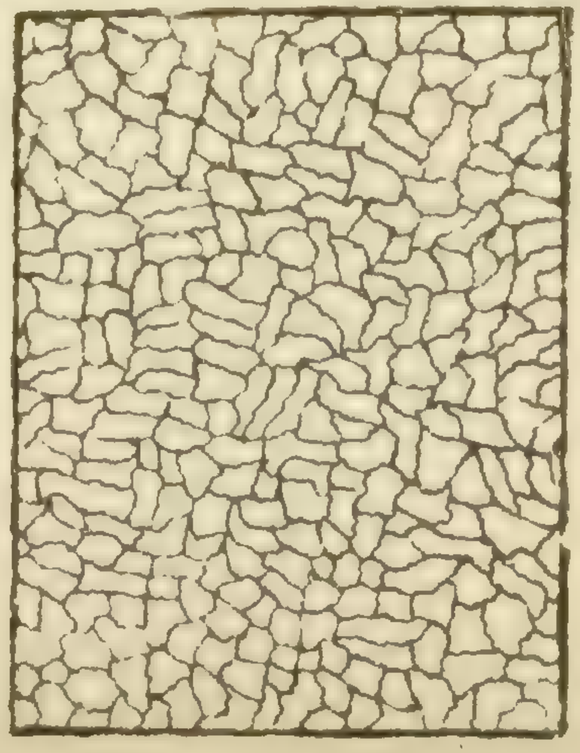


50 A. acuminatum

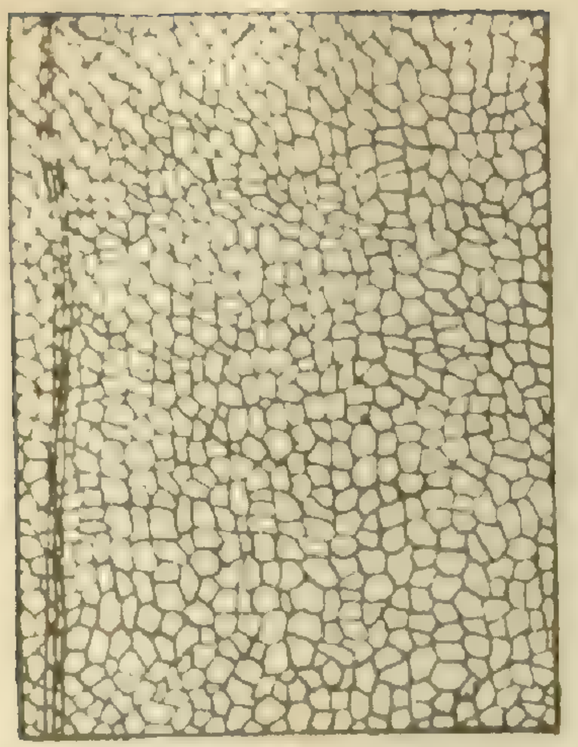


After Watson x 30 D

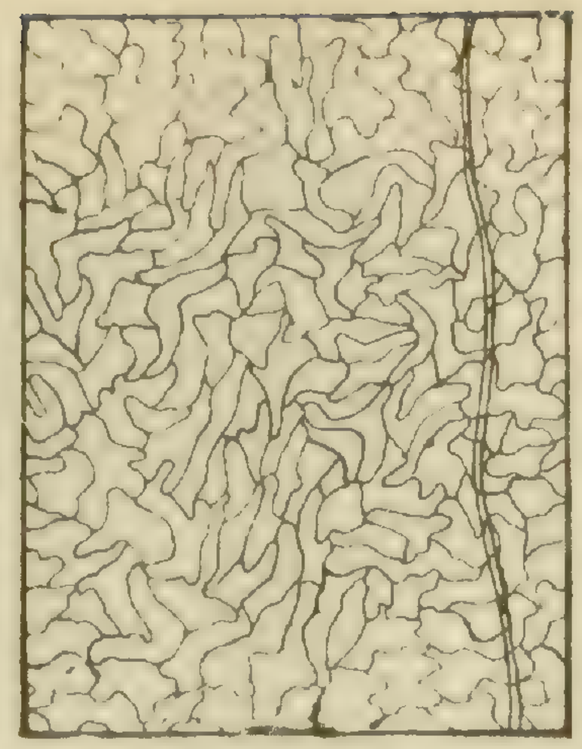
50



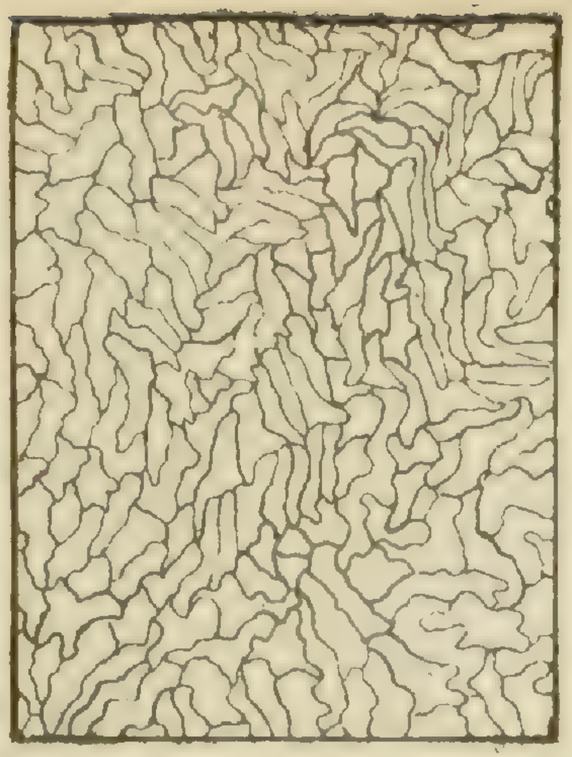
50 Near Tip



50 Inner Membrane.

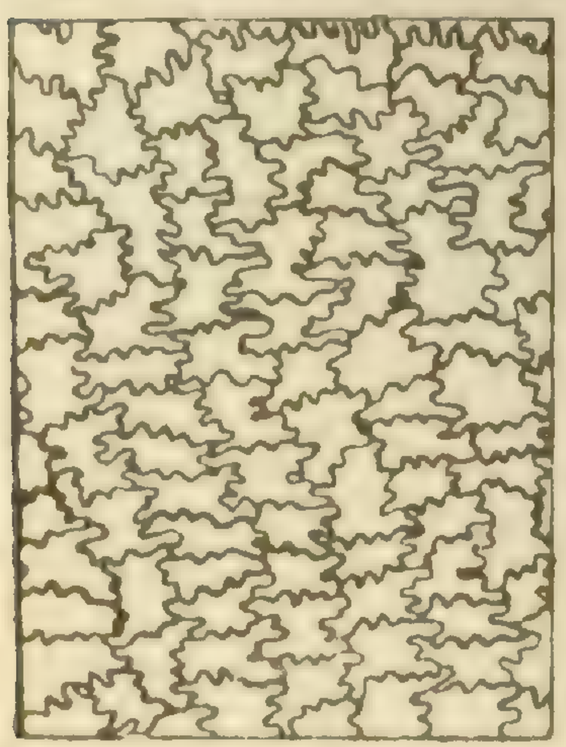


50 Outer Membrane.

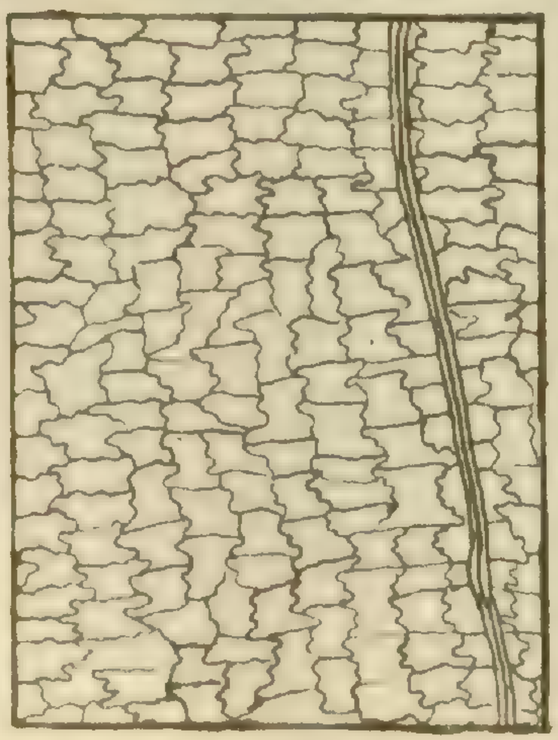


50 Outer Membrane.

52



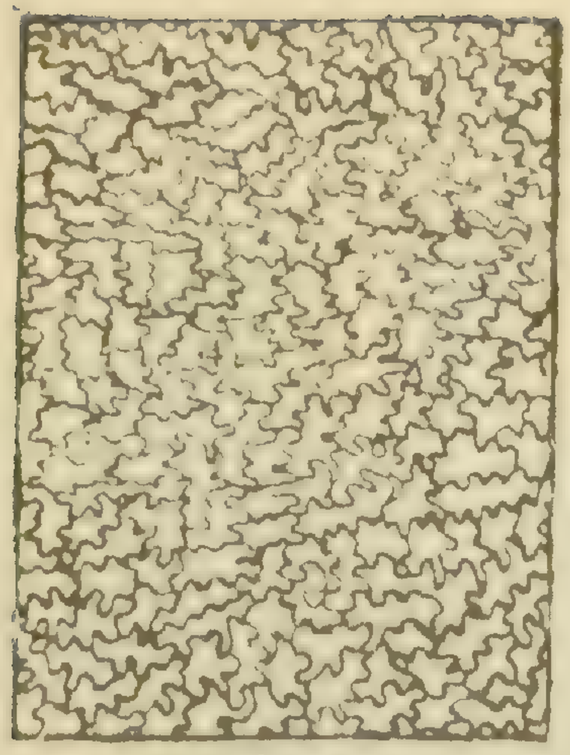
52 A. campanulatum



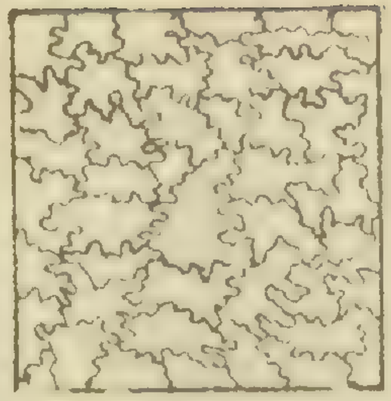
52

52 Near Tip.

53

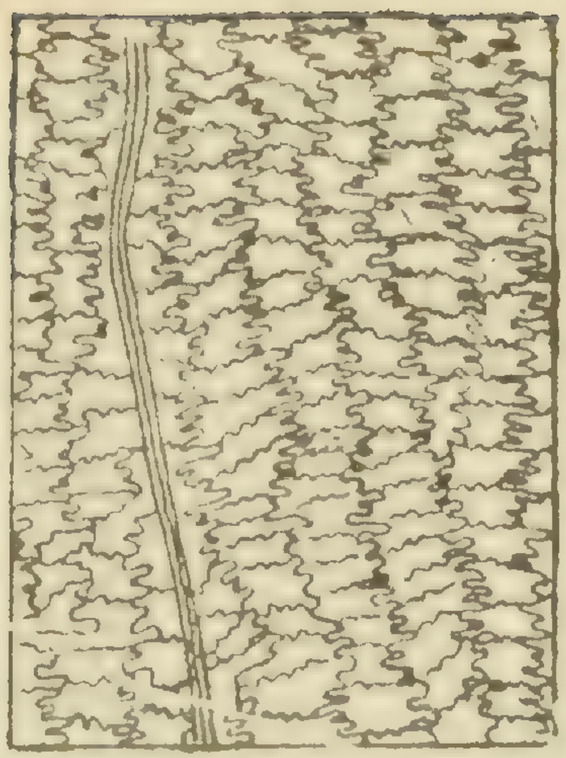


53 A. disceptrum

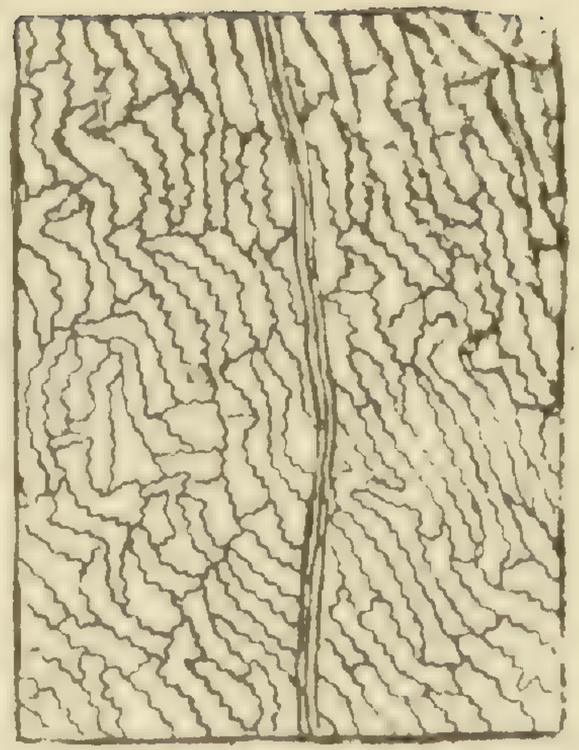


After Watson x 30 D.

53

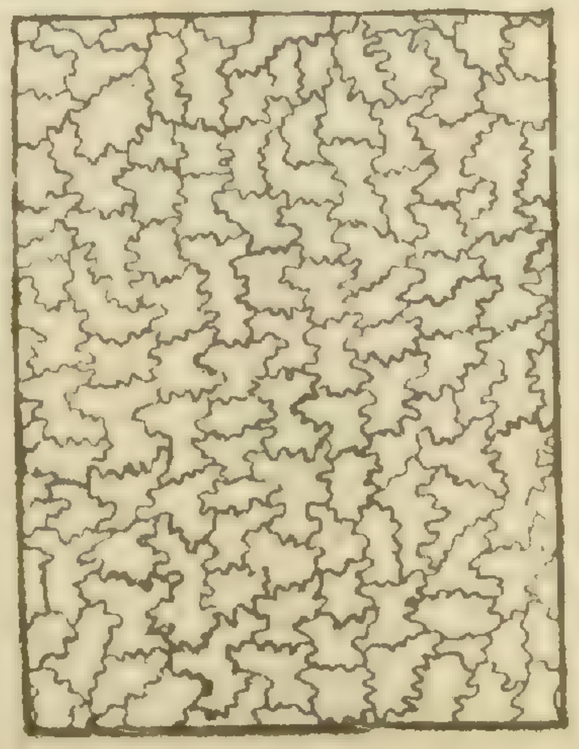


53

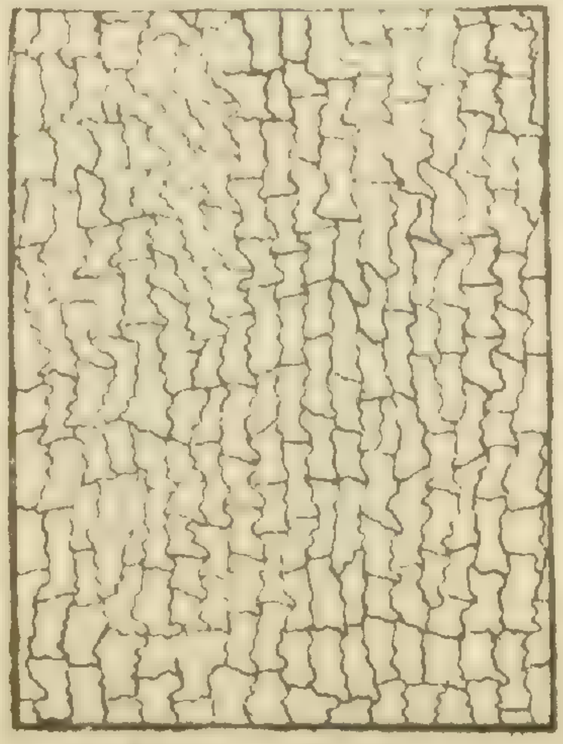


53 Near Tip.

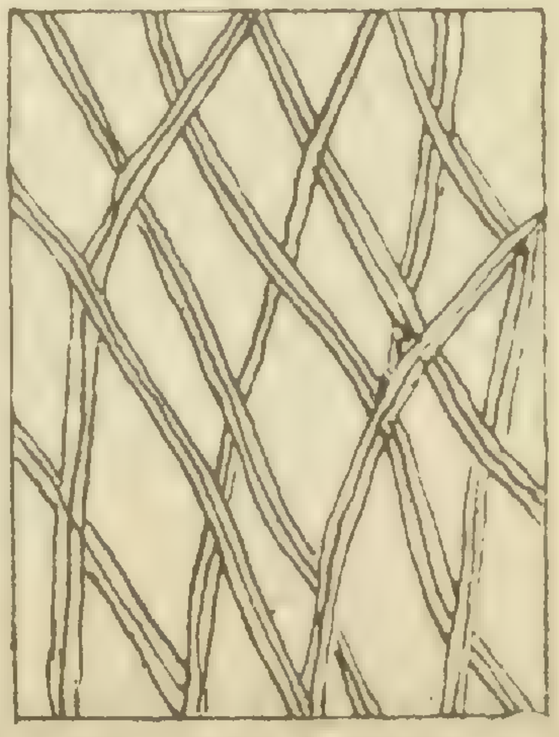
Var. Wahense



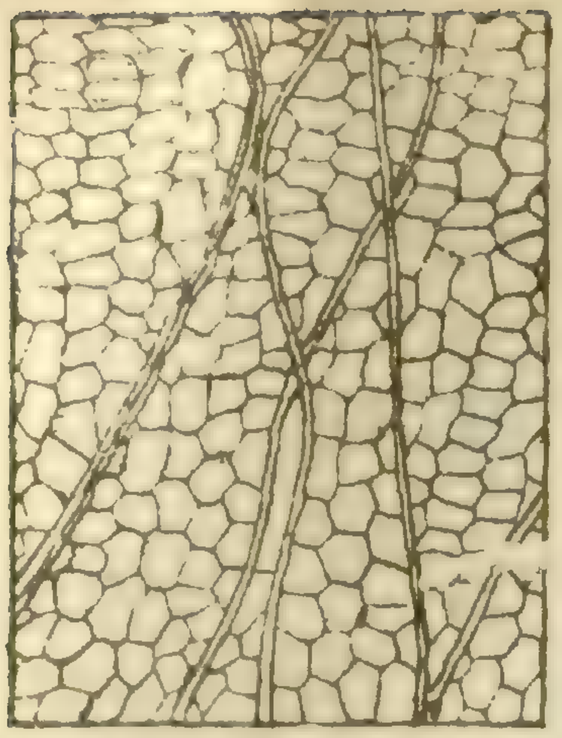
53a



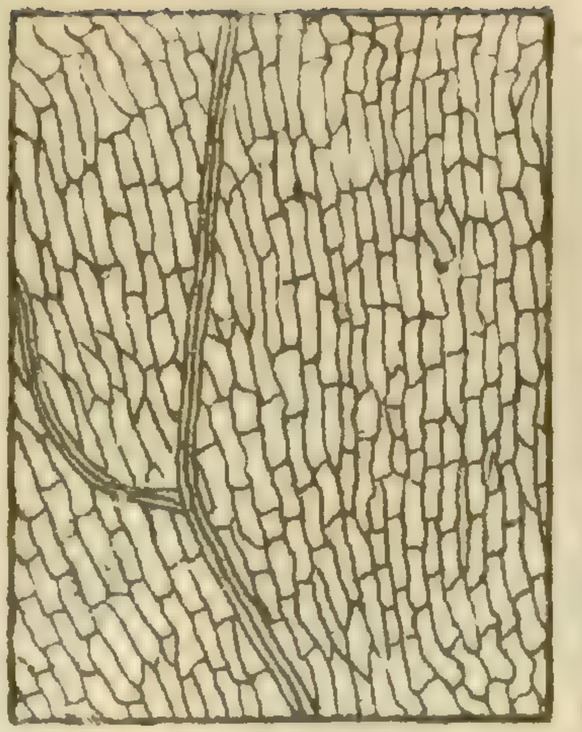
53a Near Tip



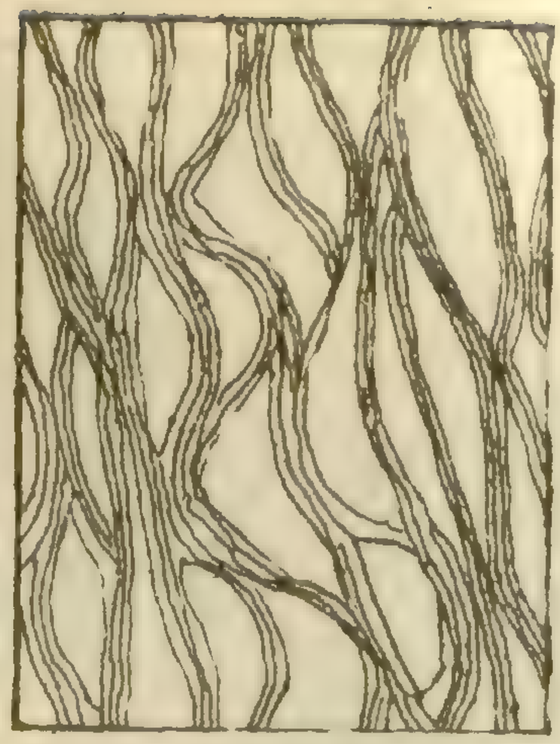
55. Var. tenerum.



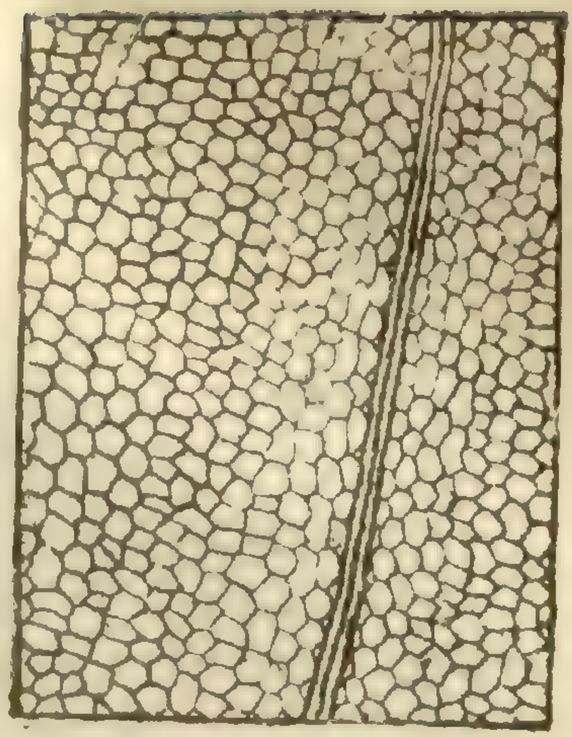
56 A. Canadense



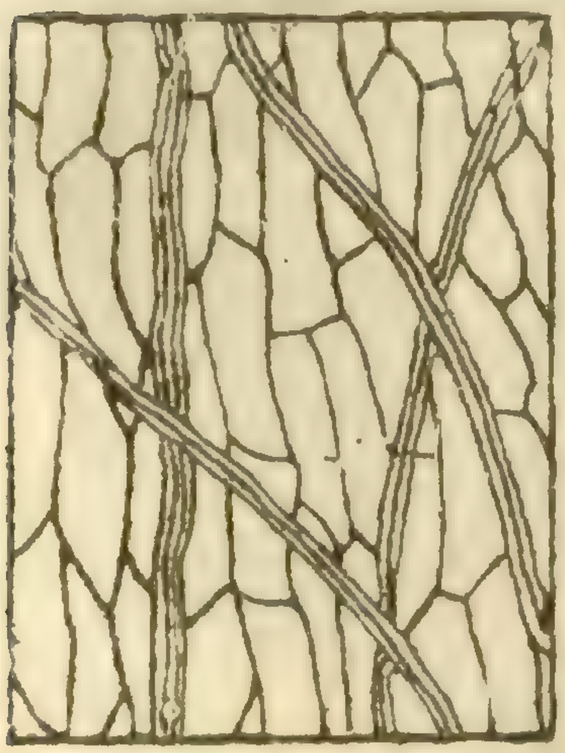
56 Outer Membrane.



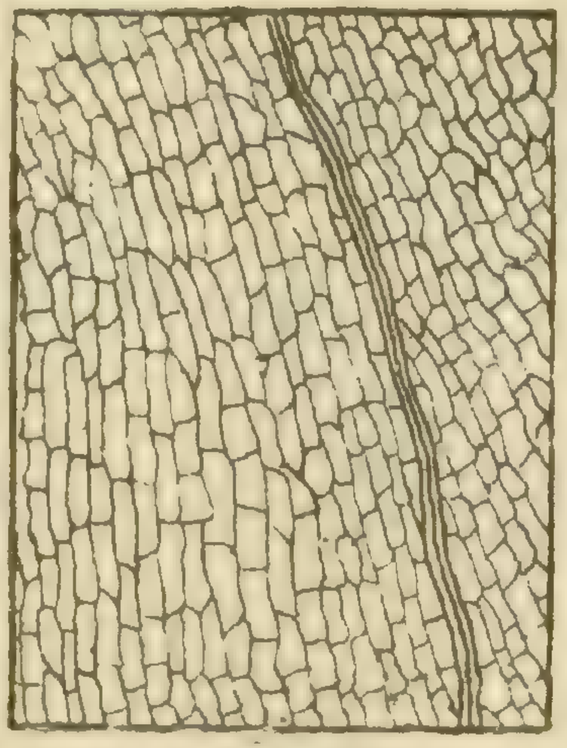
58 A. Nuttallii



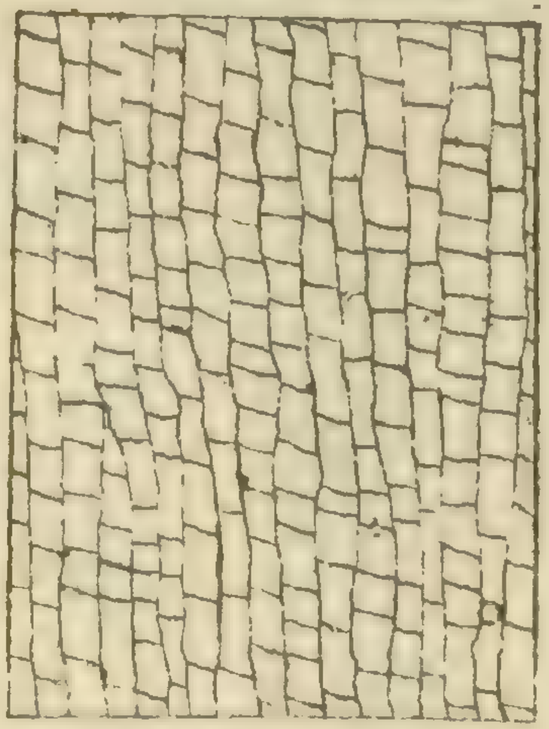
58 Outer Membrane.



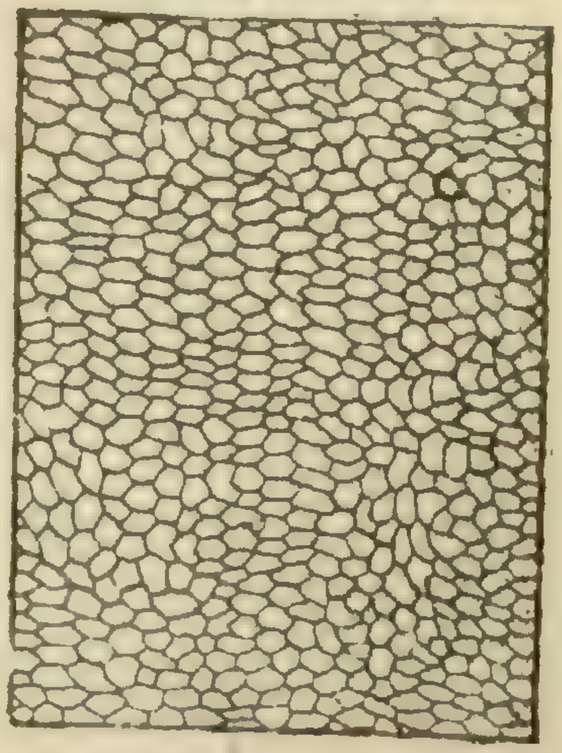
60 Var. deserticola



60 Outer Membrane.



A. pleianthum Var particolor



A. Cusickii Outer Membrane.

Outer Membrane.

PLATE 7

A. kentrophyta

A. kentrophyta var. Coloradoensis

A. kentrophyta var. rotundus

A. kentrophyta var. humosus

A. diphysus

A. diphysus var. spatulatus

A. diphysus

A. diphysus var. cimarronis

A. sericoleucus

A. sericoleucus var. arctioides

A. sericoleucus var. tridactylicus

A. humistratus

A. humistratus var. Nanus

A. humistratus var. tenerrimus

A. humistratus var. flexilis

A. flexuosus

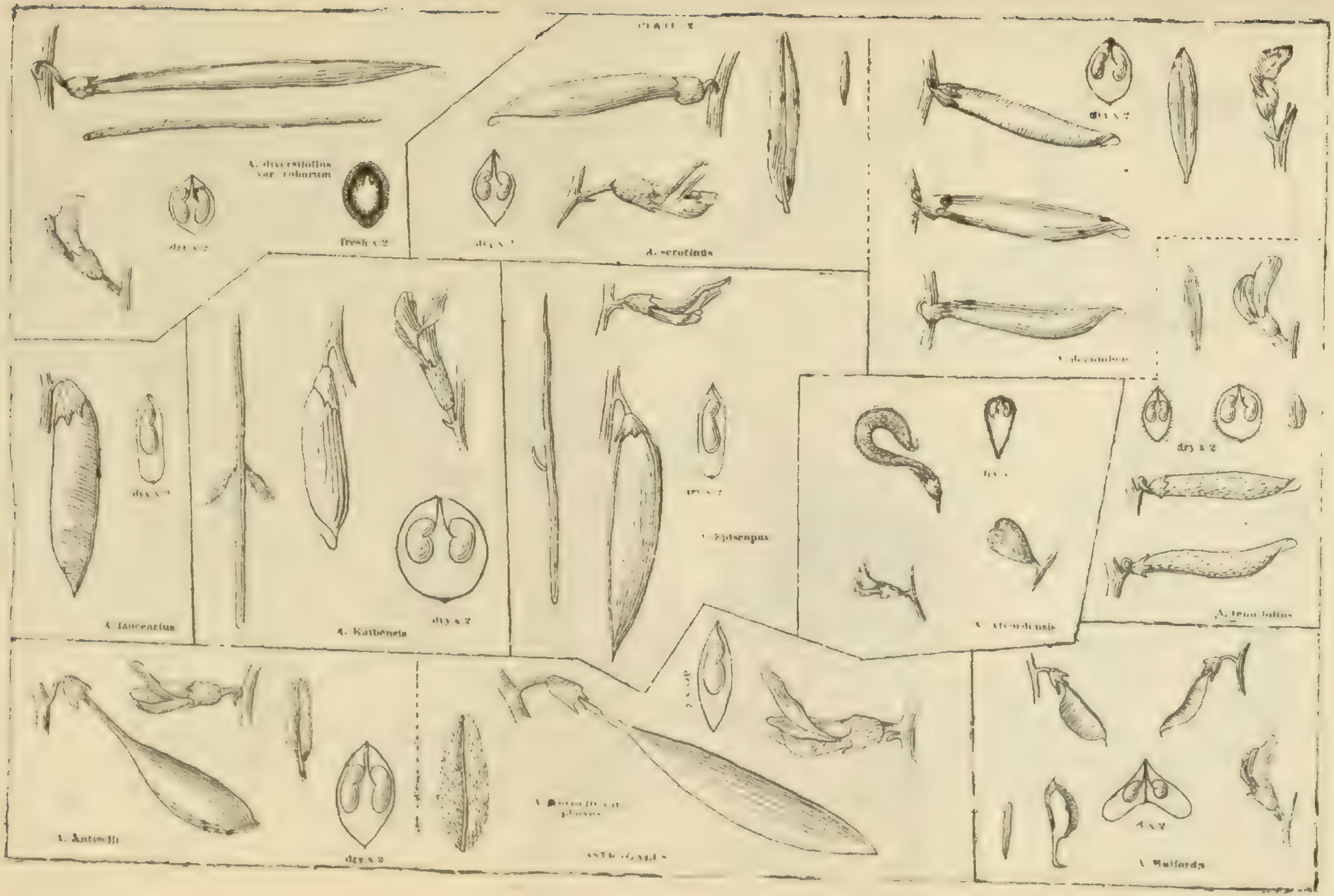
A. flexuosus var. Fendleri

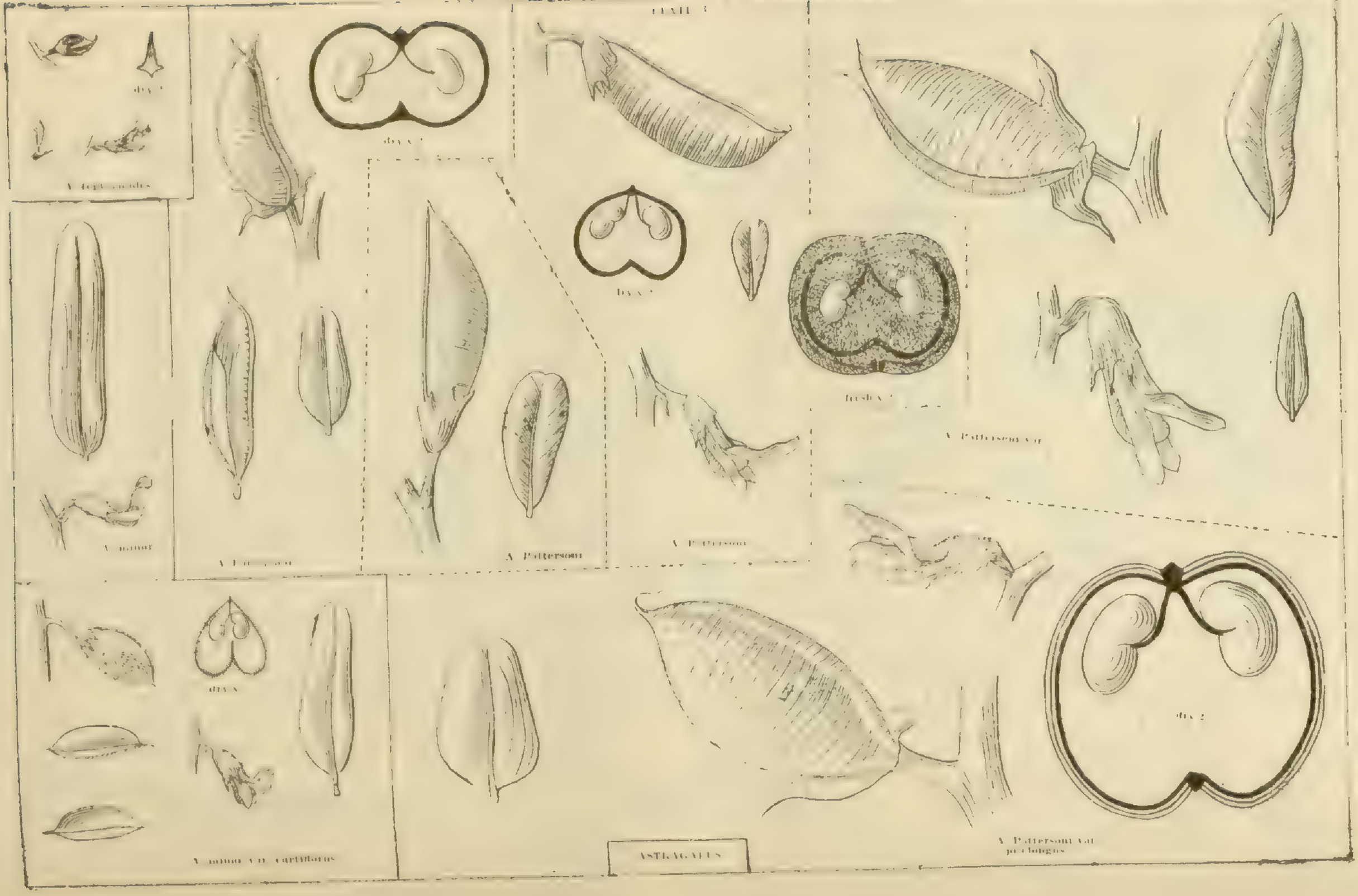
A. flexuosus var. elongatus

A. diversifolius

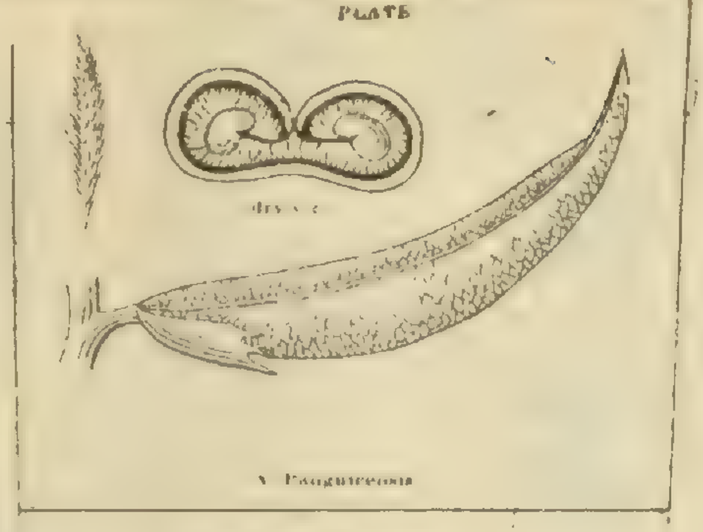
A. shoshonis

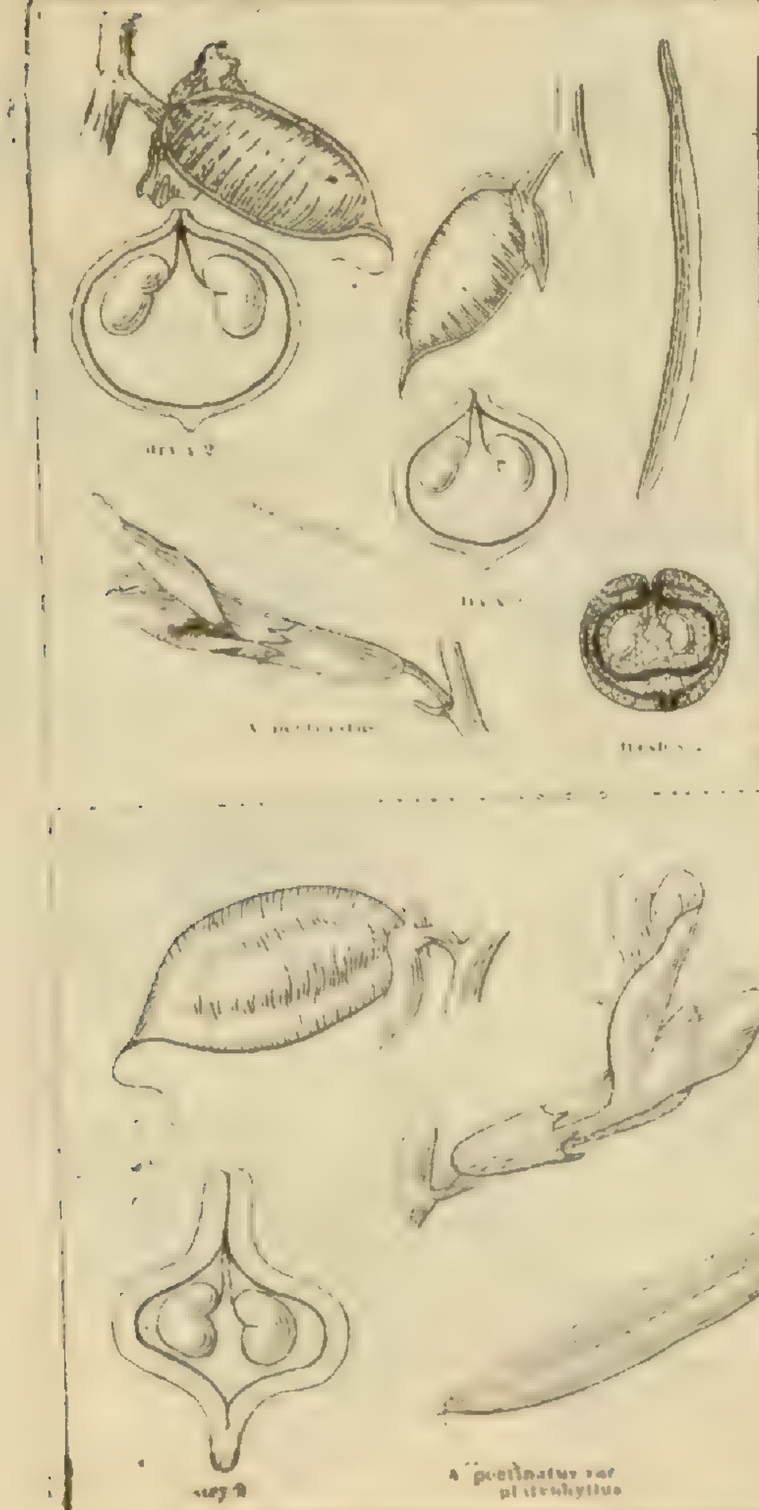
ASTRAGALUS

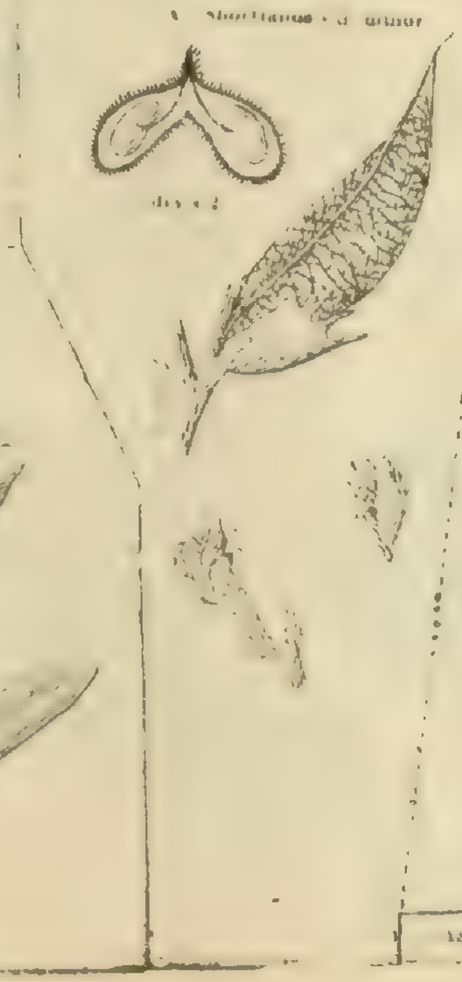

A. discretiflorus var. robustum
fresh x 2
dry x 2
A. serotinus
A. lanceariae
A. Kalbensis
A. Antonii
A. Hallfordii

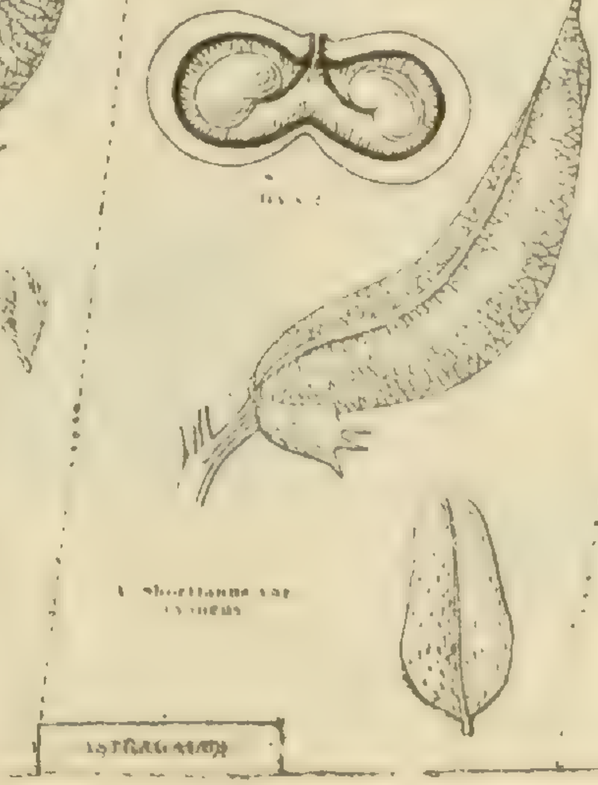

ASTRAGALUS

PLATE

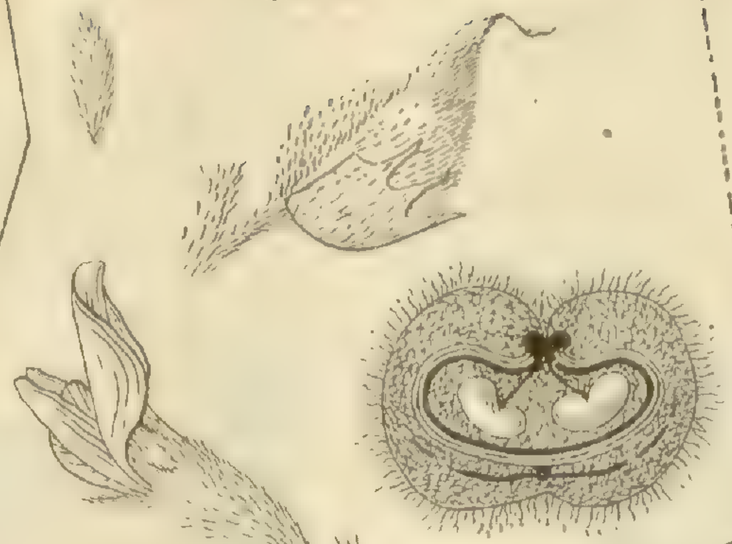






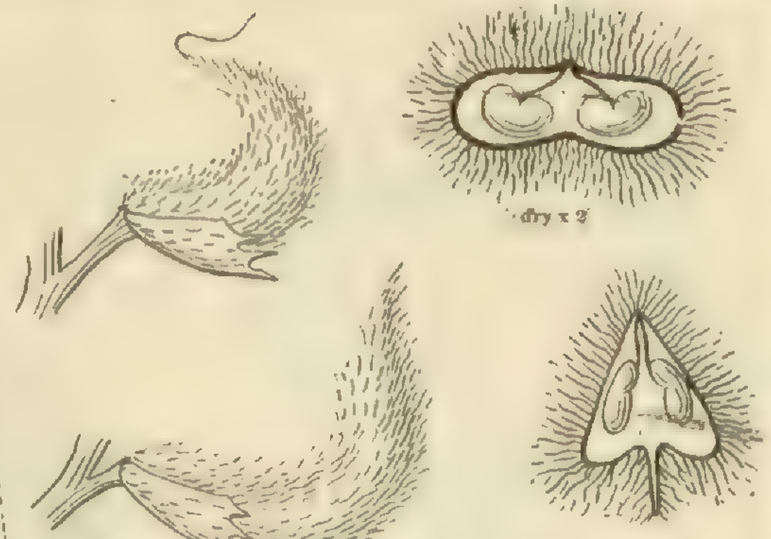


dry x 3



fresh x 2

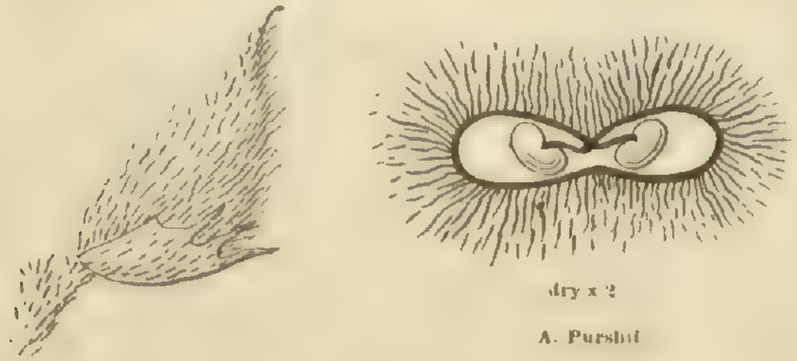
A. Purshii



dry x 2

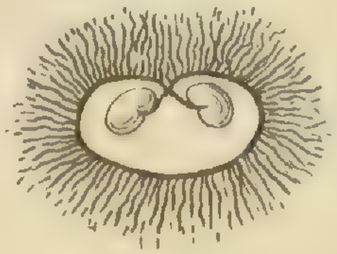
dry x 2

A. Purshii var. tinctus



dry x 2

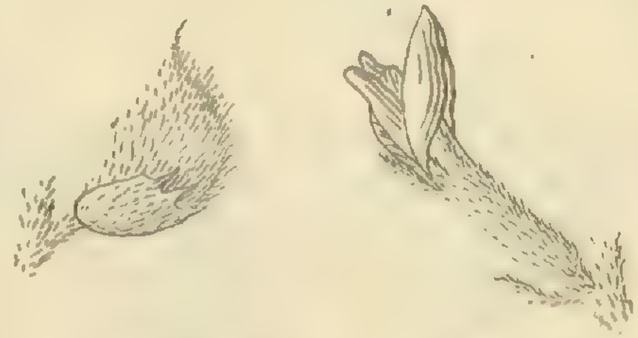
A. Purshii

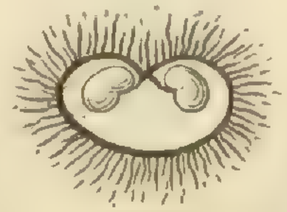


dry x 2

dry x 2

A. Purshii var. coccolobus





dry x 2

A. Purshii var. longelobus

ASTRAGALUS

PLATE

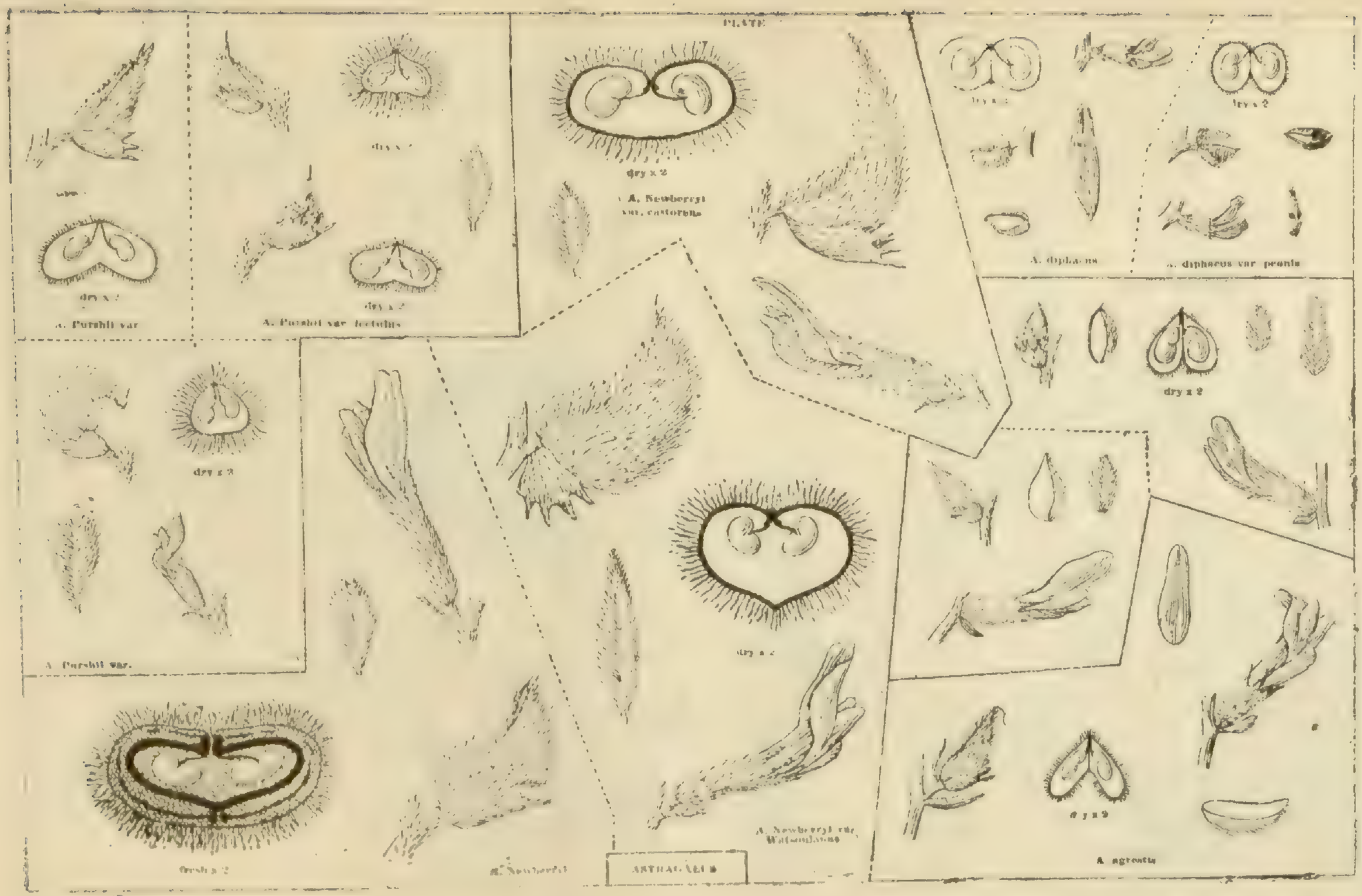
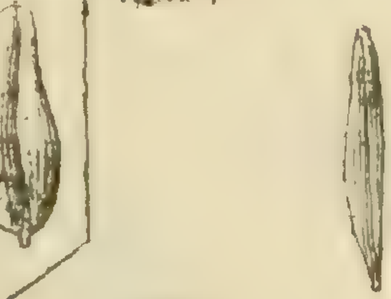
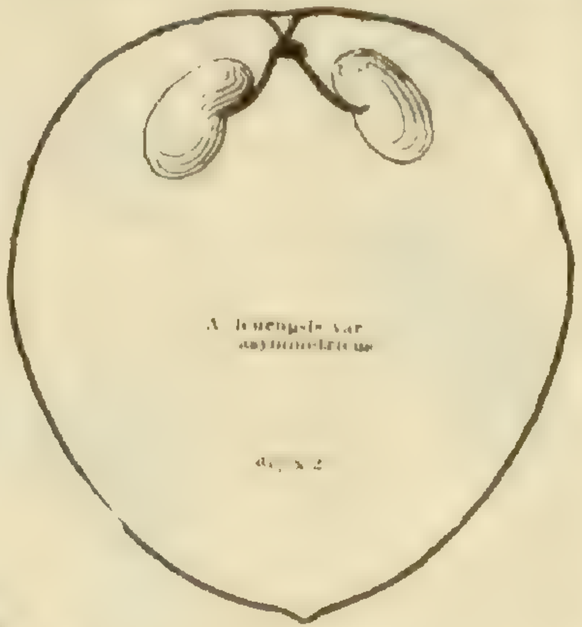
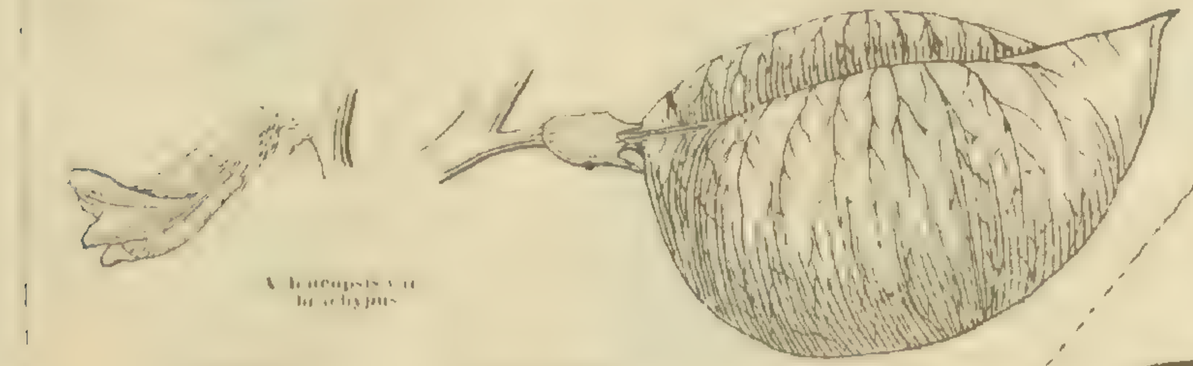
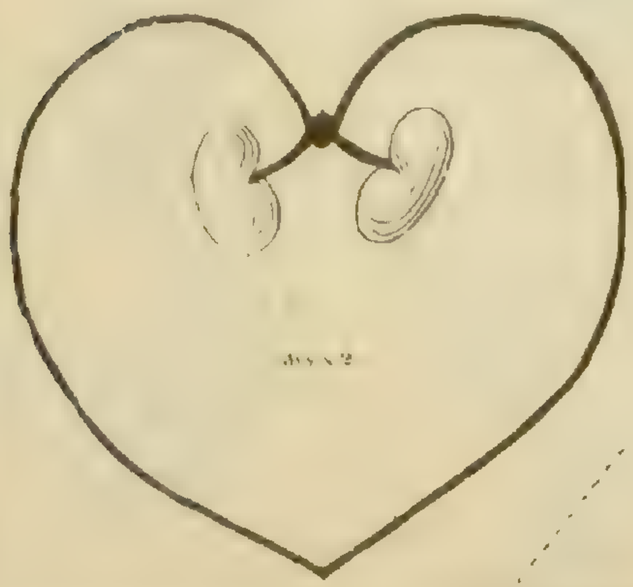

dry x 2
A. Newberryi var. castorella
A. diphacus
A. diphacus var. peonia
A. Purshii var
A. Purshii var. lecticula
A. Purshii var.
A. agrestis

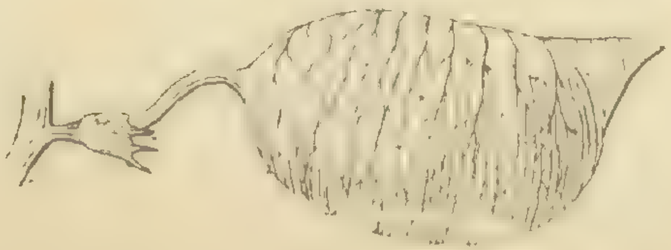
PLATE I









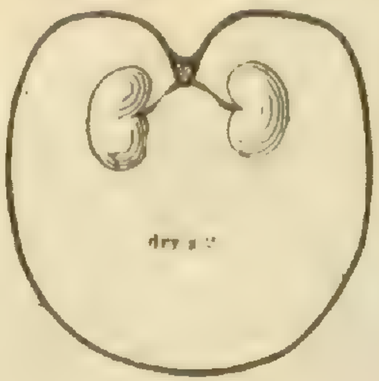


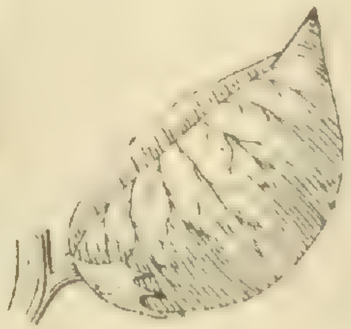
ASTIGACALIS

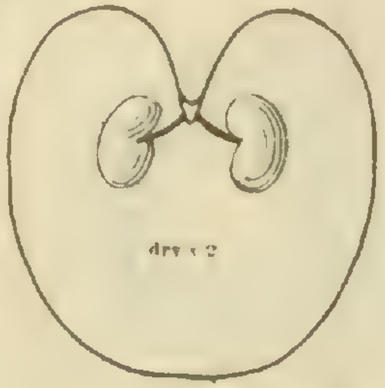
dry x 2

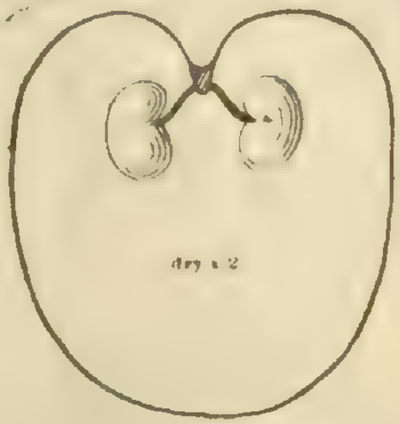
dry x 2

dry x 2









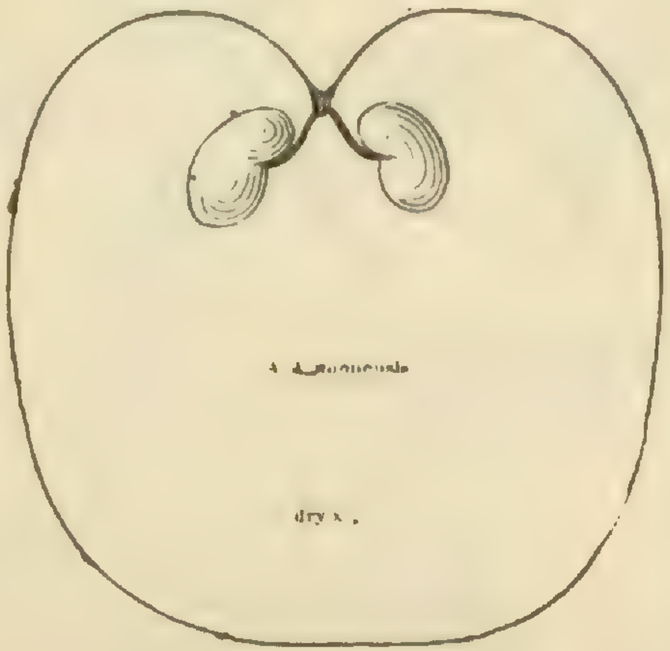
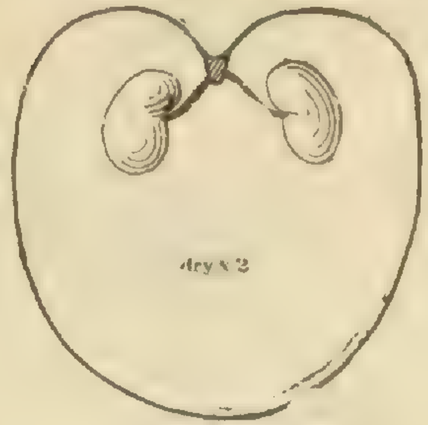
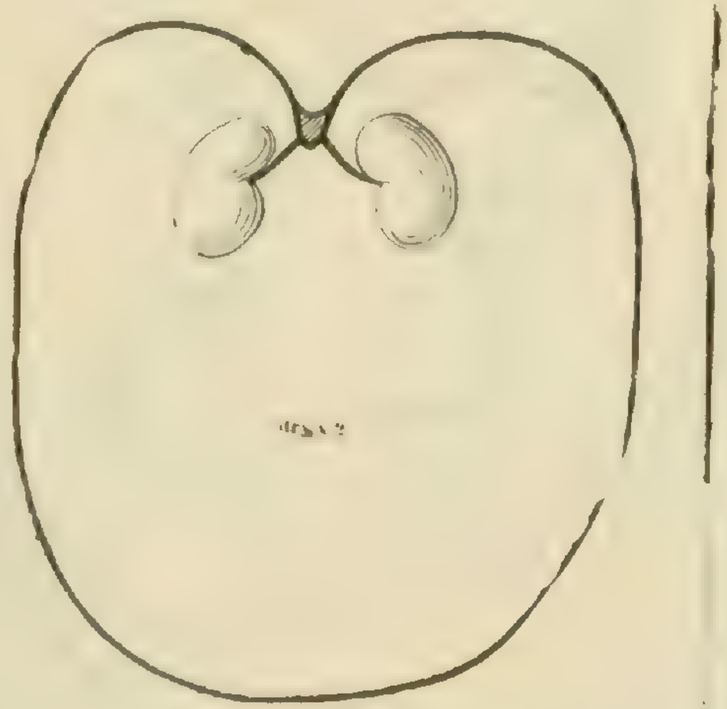


PLATE 10



A. Douglasii var.
Parishii



A. Douglasii var
Lejonensis

ANTHEMIDES

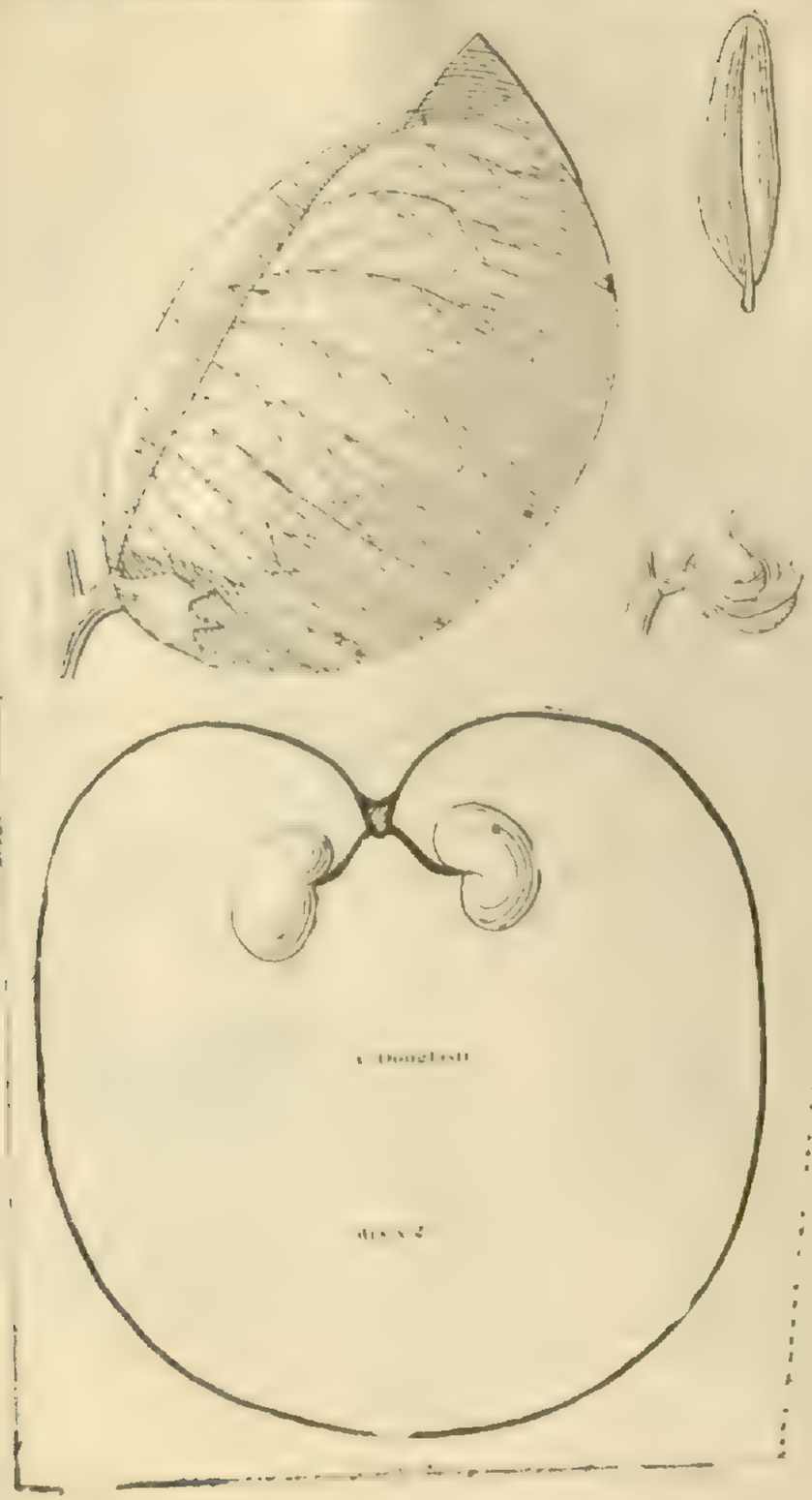
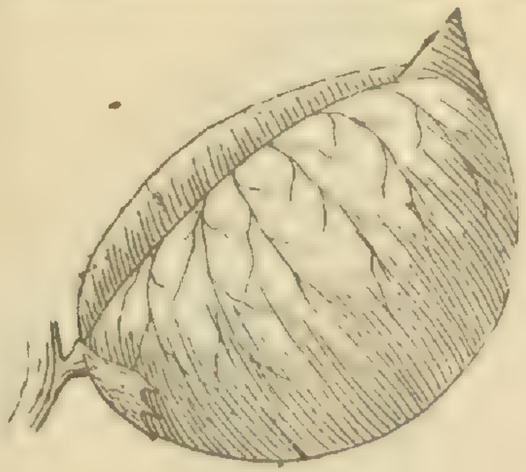
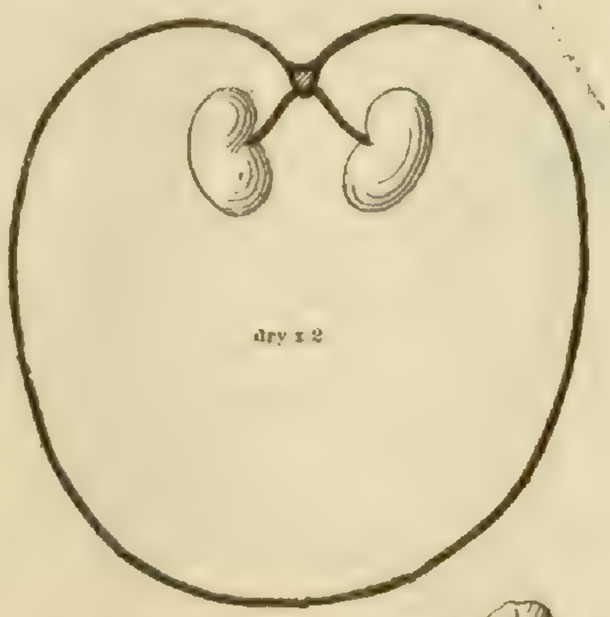


PLATE 11





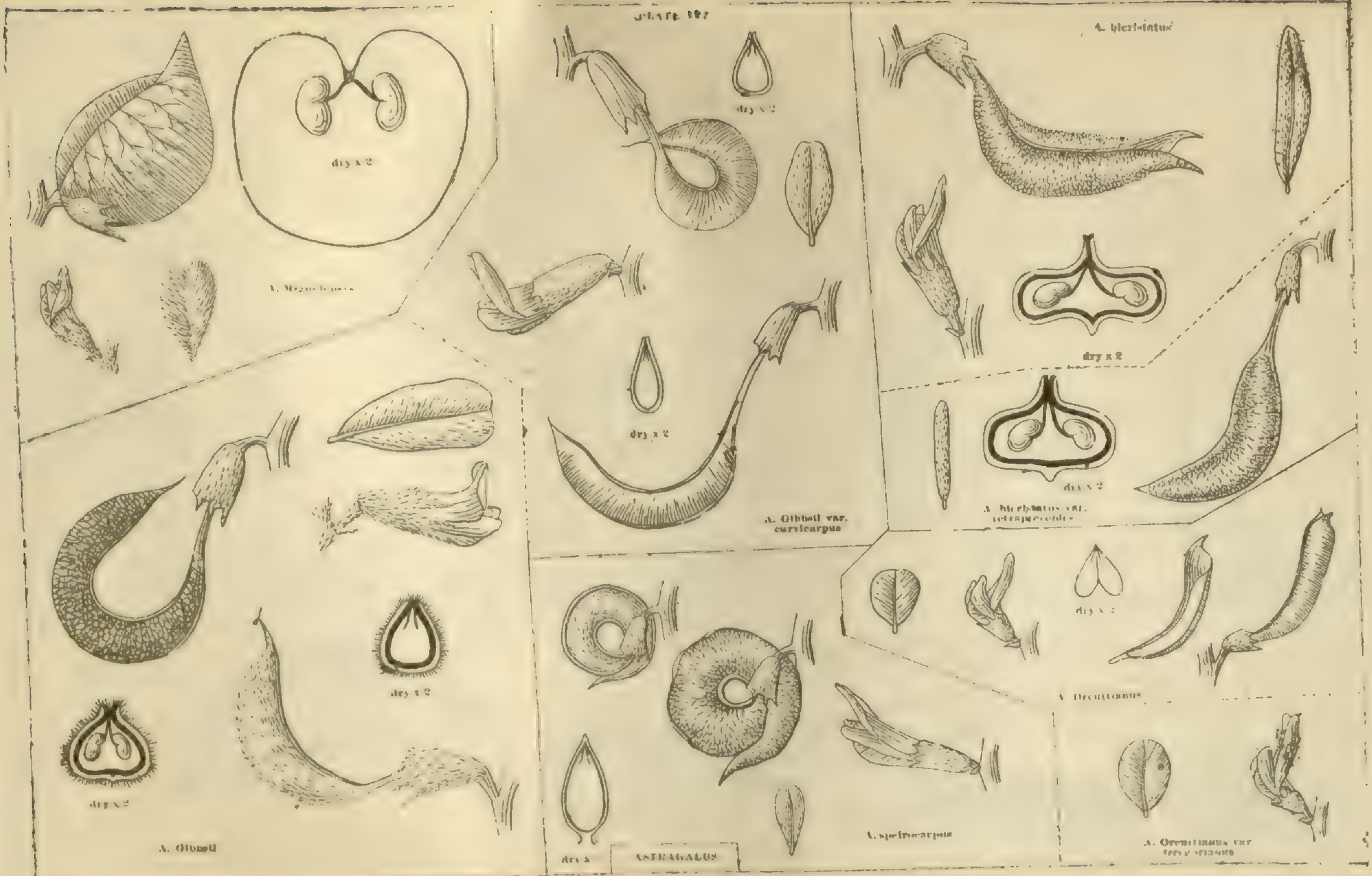

dry x 2
A. Gibbsii
dry x 2
A. Gibbsii var. curvicarpus
A. pterocarpus
A. Decumbens
A. Decumbens var. terrae-reginae
dry x 2
ASTRAGALUS

PLATE 13

A. valloris.

dry x 2

A. scaphoides

dry x 2

A. Bolanderi

dry x 2

A. strictus var. Lemmonii

dry x 2

A. strobiliferus

dry x 2

A. strictus var. Lewisii

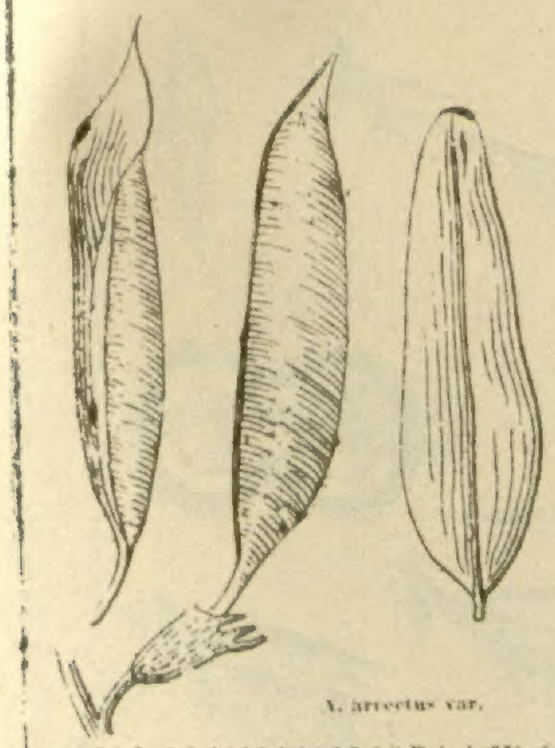
A. strictus var. Peirsonianus

dry x 2

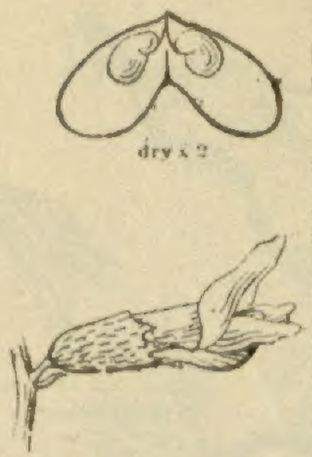
A. strobiliferus

ASTRAGALUS

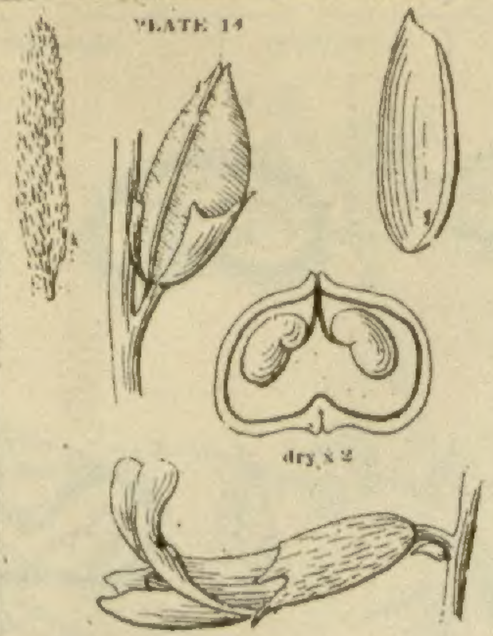
PLATE 14



dry x 2



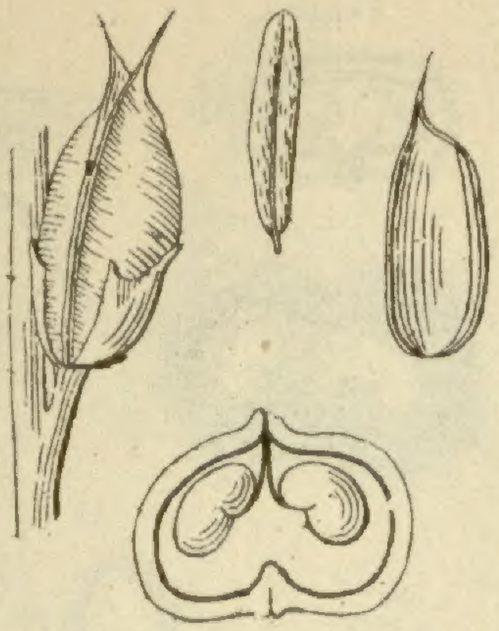
A. arrectus var.



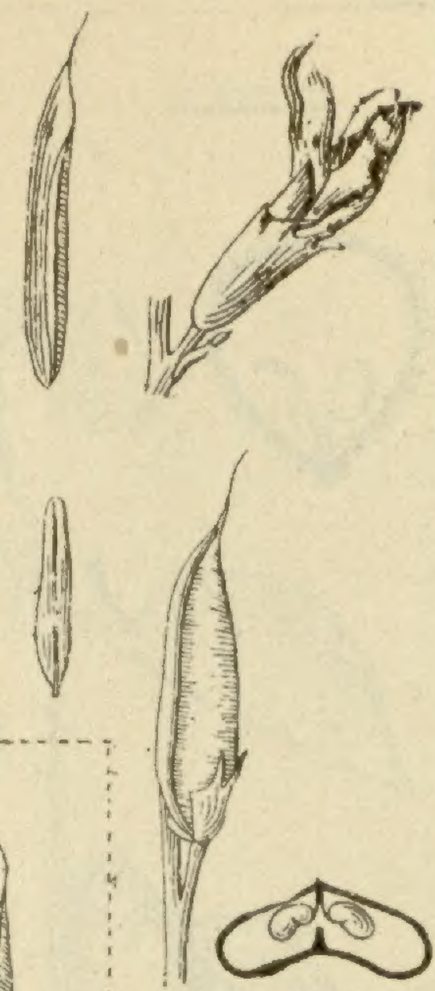
dry x 2

A. reventus

A. reventus var.

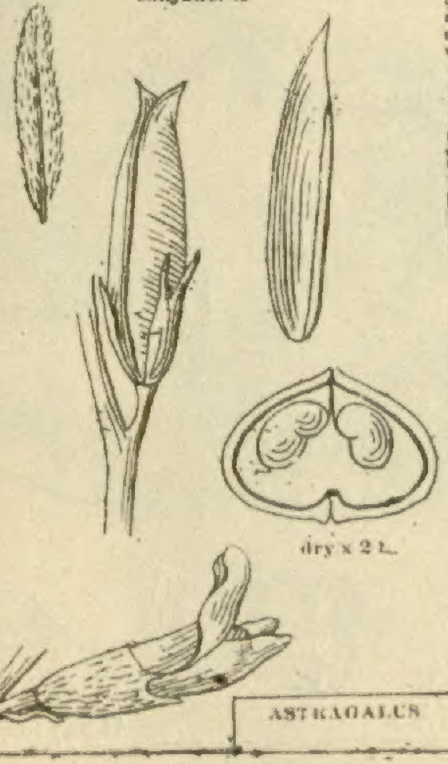


dry x 2

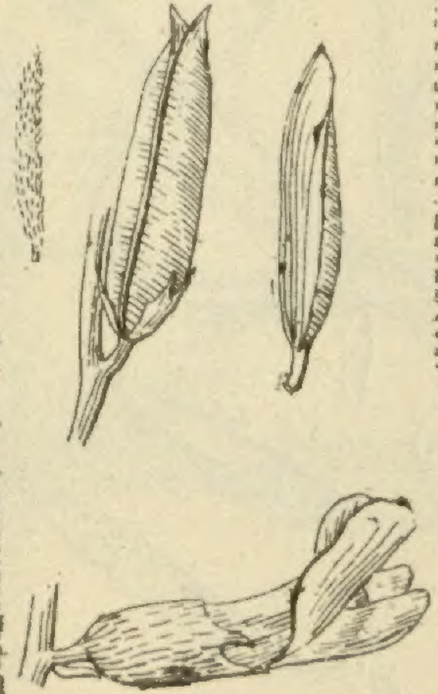


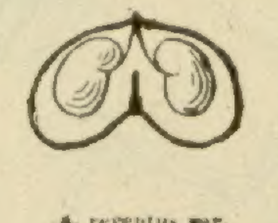
dry x 2

A. reventus var. conjunctus



dry x 2 L.





A. reventus var. conjunctus

dry x ?

A. arrectus var. apercursus.

A. Matherrensis

dry x 2

ASTRAGALUS

PLATE 13

dry x 2

A. Franciquitensis

A. Franciquitensis var. lagunensis

A. atratus

A. atratus var. phyllophorus

A. argophyllus

A. argophyllus

A. argophyllus

A. argophyllus

A. argophyllus var. tabellaris

A. argophyllus var. castaniformis

ASTRAGALUS

BOERHAVIA INTERMEDIA JONES N. SP

B. NANULOSA JONES N SP.